

**EMOTIONAL DESIGN OF SMART PANTRY FOR  
MID-AGE WOMEN**

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# **EMOTIONAL DESIGN OF SMART PANTRY FOR MID-AGE WOMEN**

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## **SUMMARY**

Emotional design addresses people's needs and desires which is at the center of product or technology development. Currently, there is no established process of emotional design in the field of industrial design to address research and design issues. A five step emotional design process is proposed in this thesis.

Research theories and methods on emotional design were reviewed. Existing pantry storage products were evaluated. User research was targeted on women between age 45 and 60. Research data were collected through interviews and surveys. Research findings were produced by analyzing the data using a proposed data analysis method called Product Emotion Baseline. Product function design, product interface design and user experience study on smart pantry were presented. All five steps of emotional design process were applied to smart pantry design to illustrate in detail how the proposed process works.

# **CHAPTER 1**

## **INTRODUCTION**

Emotional design as human centered approach addresses people's needs and desires which is at the center of product or technology development. There are three major purposes of emotional design 1) identify and measure the contextual appraisals through research; 2) translate the appraisals to product attributes, and 3) embed the identified attributes in products through design practice. The paper will present the emotional design process and employ smart pantry design as an example to show how the process works, from user research to concept development and concept testing. Emotional design is expected to evoke positive emotional reactions in the target group – women aged between 45 and 60.

### **1.1 STATEMENT OF PROBLEM**

Emotion is a mental state of the human mind. It is a person's quick judgment based on his or her personally relevant information. Emotional design has strong relation to users' knowledge (technology knowledge, previous experience, etc) and personal relevant information (financial status, self esteem, etc). It is hard to design emotion in product because it is hard to predict on individuals' emotional reactions. People's emotions are sensitive to the changes of time and environment. So, the research problems related to emotional design consist of how to collect data objectively from individuals and how to analyze the emotion-reaction data in a quantitative way.

Product emotion is an attribute of a product and it prompts users' emotion. Users respond to a product's emotion by its design – such as aesthetics, functionality and

interaction. In other words, product emotions are the anticipated emotional responses from users and they are related to identifiable product attributes. As all mass produced products are designed to accommodate a large number of users' needs, the challenge of emotional design is that a product should be able to evoke positive emotional responses among many users. The challenge in the design issue is how to test the design concept in a quantitative way.

At present, no established theories of emotional design exist in the field of industrial design that addresses the research questions and design issues. As more designers and companies get involved in emotional design, there is a need to expand the study of emotional design, and to provide usable design methods.

## **1.2 PURPOSE OF STUDY**

In the past, designers have realized the importance of emotions in product design and many have tried to create pleasant user experiences even without the guidance of a systematic design method. Through this thesis, an emotional design process has been developed. The object is to develop a research method that can analyze and measure users' emotional reactions. The research method was applied to the design process of a smart pantry in which the target user group was studied.

## **CHAPTER 2**

### **TERMS, THEORIES AND APPLICATIONS REVIEW**

This chapter defines several key terms related to emotional design. Two fundamental theories of emotion and design are reviewed.

#### **2.1 TERMS: HUMAN CENTERED DESIGN**

##### **2.1.1 *Human-centered Design***

Human-centered design is also known as user-centered design (usability study) or customer-centered design (consumer product development) under different circumstances. Human-centered design is characterized by: “the active involvement of users and a clear understanding of user and task requirements; an appropriate allocation of function between users and technology; the iteration of design solutions; multi-disciplinary design.” (International Standard Organization, ISO 13407)

Human-centered design addresses human needs and desires at the center of product or technology development. A key principle to human-centered design is to get a good understanding of the context in which people will use the technology or product. These extracted contexts help to guide the design activity to ensure both usability and desirability of the design.

##### **2.1.2 *Usability***

Usability is the effectiveness, efficiency and satisfaction from which a specified set of users can achieve a specified set of tasks in a particular environment (ISO 9241). Industrial designers enhance product usability in two ways: defining the functionality of

human machine interaction; developing the human machine interface (HMI). In both ways, industrial designers work closely with engineers, ergonomics specialists, human computer interface (HCI) specialists, marketing teams and manager groups. Defining functionality is the first step in the design process. It ensures the products are useful to the end-users. The next step is to design product behavior and structure, Human Machine Interaction and Interface, from which a good design could decrease the difficulties of understanding and increase the accessibility of the product.

### **2.1.3 *Desirability***

Desirability is the quality of being worthy of been desirable (Merriam-Webster). Desirability means different things in different contexts. In order to design desirable products, it is important to find and generalize the common use contexts. Product function and purpose is derived from the common use contexts.

### **2.1.4 *User Experience***

User Experience is the quality of experience a person has when interacting with a specific design. User experience varies under different use contexts.

### **2.1.5 *Use context***

In general, the context of a usage includes the circumstances and conditions which "surround" the use scenario ([www.Wikipedia.org](http://www.Wikipedia.org)). In psychology, context refers to the background stimuli that accompany some type of foreground event. For example, if a rat is foraging and is frightened by a cat, the place (and possibly time) of foraging is the context and the cat is the foreground event. In communications and linguistics, context is the meaning of a message (such as a sentence), its relationship to other parts of the

message (such as a book), the environment in which the communication occurred, and any perceptions which may be associated with the communication. Thus, context is a "frame" through which one views a message. In Industrial Design (ID), the use context is the circumstances under which a product is used, and background stimuli that accompany the usage event. The conditions of usage circumstances include geographic locations, environmental conditions, time and so on. Meanwhile, the background stimuli are the users' knowledge, physiological and psychological needs.

#### **2.1.6 *User Needs***

User Needs are conditions or situations in which something is required or wanted by the users. The increasing emphasis on human subjects in design practices requires ID designers to re-think how one user changes his or her needs under different contexts. In order to do so, designers first have to define the user and use context first. Then, can they research and analyze the user needs.

### **2.2 TERMS: EMOTION AND DESIGN**

The issue of relation between emotion and design has gained significant interest within design practice and design research over the last decade. More and more professional designers and researchers are beginning to realize the important role that emotions play in product design, development, production, purchase, and final use. To integrate emotions into products, there needs to be better understanding of people's emotions in relation to products. In other words, there needs to be an understanding of how product features fulfill user emotions. It is hard to generalize these product features

as they are visually hidden among many foreground stimuli. A review of other research studies in emotion in design provides a background to investigative methods.

Donald Norman, a critic Human Factor expert published his idea of Emotional Design in 2004. His book is translated into seven different languages. In 2006, he received Benjamin Franklin Medal in Computer and Cognitive Science at the Franklin Institute in Philadelphia. His works provides an inside look of how users emotionally connect with consumer products. The Design & Emotion Society in Delft, Netherlands, is an international network established since 1999 that helps researchers, designers and industrials gather together and share their insights, researches, tools and methods to support the involvement of emotional experience in product design. The following are terms frequently used in emotion and design research.

### **2.2.1 *Mind***

Mind is “the collective conscious and unconscious processes in a sentient organism that direct and influence mental and physical behavior” ([www.dictionary.com](http://www.dictionary.com)).

### **2.2.2 *Cognition***

Cognition, from Latin: *cognoscere*, "to know": The mental process of knowing, including aspects such as awareness, perception, reasoning, and judgment ([www.dictionary.com](http://www.dictionary.com)).

### **2.2.3 *Cognitive Design***

Design is characterized as a purposeful human cognitive activity. Cognitive design primarily focuses on the design process: adequately defining the users'



performance goals and preparing a solution that addresses them. Mirel (1999) suggests the need for technical communicators to shape instructions around problems experienced by users into work contexts, and to adopt problem-based instruction.

#### **2.2.4 *Emotion***

Emotion is a mental state. Emotions are “about something” (Clore and Ortony 2000; Lazarus 1994; Spielman, Pratto, and Bargh 1988; Johnson and Stewart, 2005) as opposed to being a more generalized feeling or state. In addition, emotions are experienced in relation to situations or targets that have implications for the individual’s goals or well-being (Lazarus 1991b; Johnson and Stewart, 2005). Emotion is different from mood, because moods persist longer and are less intense than emotions (Bagozzi, Gopinath, and Nyer 1999).

Research psychologists have been studying emotion for a long time. In fact, it is one of the oldest areas of research, and it focuses on two questions. The first relates to the fundamental nature of emotion. From a neuroscience point of view, current thinking is that emotion involves a dynamic state that consists of both cognitive and physical events (MIT media lab). Several classic theories of emotion exist: James-Lange Theory (Appendix B.1.1), Cannon-Bard Theory (Appendix B.1.2), Schachter-Singer Theory. Schachter and Singer agreed with James and Lange that -- the experience of emotions arise from the cognitive labeling of physiological sensation. However, they also believed that this was not enough to explain the more subtle differences in emotion self-perception, i.e. the difference between anger and fear. Thus, it was proposed that an

individual would gain information from the immediate situation (e.g. a danger is nearby) and use it to qualitatively label the sensation.

An emotional need is a craving that, when satisfied, leaves people with a feeling of happiness and contentment; when unsatisfied, leaves people with a feeling of unhappiness and frustration. Several examples of emotional needs: a need for birthday parties, peanut butter sandwiches, football game and etc.

In recent years, a lot of research in ID field has been done to focus on researching the user experience. Tyler Blake, speaking at a conference given by Philips Corporate Industrial Design in The Netherlands in 1986 first stated that product design is the design of experiences. Therefore, these studies seem to focus on the question of how to represent the complex phenomenology of emotion across many different situations. In the field of psychology, a merging group of theories of Appraisal Theory (Section 2.3) became a unifying theory to address this issue. Appraisal Theory is also highly recognized in Marketing Consumer Researches.

Donald Norman (Appendix B.1.4) provides us an easier way to look at it. He points out that emotions are the result of three different levels of the brain: the automatic, pre-wired layer, called the visceral level; the part that contains the brain processes that control everyday behavior, known as the behavioral level; and the contemplative part of the brain, or the reflective level (Norman, Emotional Design, 2004). Because of the different level of brain activities, it requires the designers to analyze the phenomena of user emotion response in three different levels. This approach helps to find the reasons behind these responses.

### **2.2.5 *Function***

Function is “the special kind of activity proper to anything; the mode of action by which it fulfils its purpose” (Oxford English Dictionary); “a particular purpose for which a person or thing is specially fitted used for which a thing exists” (Merriam Webster Dictionary); “A procedure within an application” [computer science]; “A variable so related to another that for each value assumed by one there is a value determined for the other” [mathematics]. Product function is “the results of the artifact’s behavior”, and the product behavior is “the artifact’s actions or processes in given circumstances.” (Rosenman and Gero, 1998).

### **2.2.6 *Product Emotion***

Product Emotion is an emotion evaluation or emotion attachment from users. Users judge a new product on a series of product features based on their knowledge and expectation. Users also attach their emotions to products through usage. These product features could be classified into three categories. For the traditional industrial products, they only contain two categories: 1) fixed product features (such as aesthetics); 2) users’ attachment (such as customization). For the smart products with artificial intelligence, besides the previous two, it also includes contextual cognition (such as artificial emotion). A smart product is able to capture users’ emotion, and then respond accordingly using its artificial intelligence rule base (rule system that specifies information that applies to all the problems that the system may be asked to solve).

### **2.2.7 *Emotional Design***

The ultimate goal of product design is to create a pleasant user experience. There are three major tasks of emotional design 1) identify and measure the contextual appraisals which could arouse positive emotional reactions from users through design research; 2) translate the appraisals to product attributes, and 3) embed the product attributes through product design to create product emotion. In his book *Emotional Design*, Donald A. Norman's points out that, in order to elicit the emotions in products clearly, we may analyze them in three levels: visceral level, behavior level and reflective level. The visceral level of design works by what cognitive scientists call "pattern matching". The behavioral and reflective levels, however, are very sensitive to experiences, training, and education (Donald A. Norman, 2004). From product design perspective, design on visceral level is about designing appearance, touch and feel which give initial impact of a product; behavioral level is about creating a pleasurable user experience through product function, performance and usability; reflective level relates to integrating a user's personal identity into his or her personal product. (Donald A. Norman, 2004).

## **2.3 RESEARCH THEORY: APPRAISAL THEORY OF EMOTION**

Although emotion is widely recognized in all design fields, systematic inquiry into the detection of emotion and its effects on user response has been hindered by the lack of a general theory that can explain the complex nature of the process and phenomenology of emotional response. However, there are several classic theories from other fields that will help understanding and developing the needed methods.

As mentioned earlier, Appraisal Theory is a unifying approach to the study of emotion, because appraisal theories have provided the most convincing and

comprehensive answers to the theoretical and practical questions about the nature of emotion (Ekman and Davidson 1994, Scherer, Schorr, and Johnstone 2001). This theory has been studied and provided considerable evidence to support the conceptualization of emotion that is inherent to appraisal theories (Johnson and Stewart, 2005). Appraisal theory also helps ID designers or researchers to identify the key facts that is needed to appraise the product and generalize the use contexts.

Appraisal theories define emotion as a mental state that results from processing, or appraising, personally relevant information (e.g., Frijda 1993; Frijda, Kuipers, and Schure 1989; Lazarus and Smith 1988; Ortony, Clore, and Collins 1988; Roseman, Spindle and Jose 1990; Schere 1988; Smith and Dllsworth 1985). An appraisal is a “direct, non-reflective, non-intellectual automatic judgment of the meaning of a situation (Arnold, 1960, p.170)”. Appraising is the processing of information that leads to emotional response, while appraisals are the “conclusions” that are reached through processing, which define the tenor of the emotion experienced (Lazarus 2001). A basic appraising is to determine whether a situation is “good” or “bad” in terms of individuals’ goals. More advanced appraising could differentiate emotional reactions across situations and individuals, such as someone having a “fear of wildfire”, but not “fear of fire in the pit”. It also provides a framework for the study of the process and evolution of emotional response over time.

The model of appraising consists of three processes: 1) the antecedents of the appraisal process, 2) the process of appraising personally relevant information, and 3) the consequences of appraisal and emotions. See Appraisal Model of Emotion (Appendix B, Figure B.2.1). The process of appraising includes six dimensions – direction of goal

congruence, agency, certainty, normative/moral compatibility, goal importance and the degree of goal congruence – which is used to differentiate discrete emotional reactions (Appendix B, Table B.3.1 Dimension of Appraising; Table B.3.2 Appraisal Combinations).

Applying Appraisal Theory in product design, a product's feature (aesthetics, functions and etc.) will direct an emotional reaction of a user if it either matches or mismatches the user's need. If this happens, designers will be provided adequate opportunity to get into users' mind, forecast their emotional reaction and deliver the right products to the right customer. Work has begun to find those stimuli or appraisals to guide design process and ensure that the final design is emotionally well considered.

## **2.4 DESIGN METHOD: PFBS DESIGN METHOD**

Design is a purposeful human activity in which cognitive processes are used to transform human needs and intent into an embodied object (M. A. Rosenman and J. S. Gero, University of Sydney, 1998). P is the purpose; F is function; B is the behavior; S is Structure. Purpose only exists when related to human values of utility. The process of interpreting function for purpose is the process of realization of possible utilities, whereas the process of interpreting required purposes as desired functions, and desired behaviors is a process of problem formulation. The interpretation of structure to determine the behavior and function of a proposed structure is the process of analysis. The process of evaluation is the process of comparing values of like concepts (M. A. Rosenman and J. S. Gero, University of Sydney, 1998). Overall, structure exhibits behavior, affects function, and enables purpose. Purpose enabled by function, achieved by behavior, and exhibited

by structure (M. A. Rosenman and J. S. Gero, University of Sydney, 1998). PFBS is the extension of FBS design model. FBS design method is developed by John Gero and the design research group at the Key Center for Computing at the University of Sydney.

## **CHAPTER 3**

### **RESEARCH METHODS**

#### **3.1 RESEARCH HYPOTHESES**

- Products can depict people's emotions. Products with emotions are more usable and desired. Designers can create product emotions by designing product aesthetics, functionality and interaction.
- Quantitative research approaches are important to measure emotion appraisals. However, qualitative research should be done ahead to identify the appraisals.
- Target user group have special needs on home storage. Current pantry storage products do not fulfill their needs.
- People want to have a computerized pantry storage system to help them organize their groceries.

#### **3.2 RESEARCH QUESTIONS**

##### **3.2.1 *General Questions***

- What is the relation between Design and Emotion? (theory of emotional design)
- What is human emotion? (theory of emotional design)
- How are emotions started? (theory of emotional design)
- What is product emotion? (theory of emotional design)
- How does a product deliver its emotion to the user? (theory of emotional design)
- What are the characteristics of women 45-60? (reflective level of emotional design)
- What are these women's current lifestyles? (reflective level of emotional design)



- What are these women's physical conditions and challenges? (behavioral level of emotional design)
- What are these women's mental states? (behavioral level of emotional design)
- What are these women's pantry storage needs? (reflective level of emotional design)
- What are these women's pantry storage product preferences? (reflective level of emotional design)
- What are these women's perceptions or attitudes to smart products? (behavioral, reflective level of emotional design)
- What is smart pantry? (theory of emotional design)
- Why is emotional design important to smart pantry? (theory of emotional design)
- What kinds of needs are satisfied when users are using the smart pantry? (Reflective Level of Emotional Design)
- What are the appraisals of product aesthetics? (Visceral Level of Emotional Design)
- What are the appraisals of product functionality? (Behavior Level of Emotional Design)

### **3.3 RESEARCH PROCEDURES**

The research process begins with the literature review. In-depth interviews were the pilot research for survey. The insights and findings from the interviews were used to generate test appraisals. The online survey is designed to gather quantitative data so that designers can have a standard of appraising measurement. Correctly measuring appraisals is as important as accurately identifying appraisals.

#### **3.3.1 *Literature Review***

The literature review is very important to this study. Emotional design requires enormous amounts of data from different aspects which are impossible to be gathered by individual designers or from individual studies. There is no established design method since the concept of emotional design is still relatively new to the field of industrial design. The methods employed in this thesis were developed by reviewing the classical theory and previous studies done by others. The literatures reviewed crossed disciplines from industrial design to architecture design, human computer interaction, engineer psychology, medical science and business marketing. The findings from literature review are presented in chapters 4 and 5.

### ***3.3.2 In-depth Interview and Photo Ethnography***

The interview included two sections: questionnaire interview and photo ethnography. The interview was conducted between April 1<sup>st</sup> and May 6<sup>th</sup>, 2006. All interviewed participants are working female between 45 and 60. Each interview took approximately 45 minutes. Each interviewee was required to take pictures of their current pantry and kitchen. Findings are present in chapters 4, 5 & 6. Detailed survey notes are attached in Appendix A.

### ***3.3.3 Online Survey***

The survey website was open from May 1<sup>st</sup> to June 20<sup>th</sup>. Participants were recruited through email and external sources. Overall, 71 people completed the questionnaire, 23 were female between 45 and 60 years old; 21 were female under 45 years old; 2 were female above 60 years old; and 25 were male. 78.3% of the female aged between 45 and 60 are currently working. Those who took the interview did not

participant in this survey. Overall, there were 30 people from the target group who participated in the study. Findings will be presented in chapters 4, 5 & 6. Detailed survey notes are attached in Appendix A.

### **3.4 RESEARCH DESIGN PROBLEM**

#### ***3.4.1 How to collect emotion-reaction data objectively***

Occasionally, designers gain subjective data from themselves as well as from others. For example, when a designer is asked to redesign the layout of numeric buttons for an existing cell phone, besides usability test, life style survey or a small team focus group, his or her personal user experience in this particular product also play an important role in understanding other testers' problems and reactions. However, in order to gather and analyze the emotion-reaction data objectively, designers or researchers have to separate their opinions from the subjects'. This problem was overcome by interviewing unknown subjects.

#### ***3.4.3 How to analyze the emotion-reaction data in a systematic way***

The third problem is that it is not easy to generalize and categorize emotion-reaction data in a systematic way, because it is complex, unpredictable and nonlinear in nature. In this study, appraisal theory of emotion and usage of its 3-step method was used to find users' needs, need intensity and judgments. This study also use Donald Norman's 3-level of emotion classification model to classify product emotions.

### **3.5 RESEARCH DESIGN STRATEGIES**

#### ***3.5.1 Data Collection Technique: Identify Emotional appraisal***

Past researches, using both attribution theory (Appendix A.1.7) and the cognitive dimensions (Appendix B.1.6) of emotional response, has clearly demonstrated that different interpretations, or appraisals, of a given situation routinely occur. Although emotions are personal, the conditions that underlie and elicit them are universal (Pieter M A Desmet, Delft University of Technology, Netherlands). From the last chapter, it is known that a major task of emotional design is to identify the emotional appraisals. Before the appraisals are found, the contexts to emotion arousal need to be defined first. It is what is called antecedents of the appraisal process in Appraisal Theory. Figure 3.1 shows that there are three categories of contexts for users: sensation, physical and psychological context. People judge a product by the sensation stimuli of look, touch, hear, smell and taste. The usage environments are decided by physical elements such as time, dimension and location. Here, time is a very special element. It interacts with everything. Because of the time factor, designing smart products become more complicated as people's needs change over time. This might answer the question why companies need to launch new products every year, even though the products do not have significant technology improvements. The third category is psychological context such as social or personal motivations of social status, self image, marketing effort, etc.

Category		Appraisal
Sensation	See	Movement, speed, color, shape, pattern, language, symbol, material
	Touch	Pressure, Vibration, shape, Texture, temperature
	Hear	Language, type of sound and music, volume
	Smell	Order, aroma, no smell
	Taste	Sweet, sour, salty, bitter, spicy
Physical Context	Time	Create: history, experience, memory, knowledge
	Space	Size, distance, location
	Surrounding	Light, noise, decoration, activity
Psychological Context	Social	Consider: Inter-personal influence, Social Image, social class, marketing effort Choose: Function, Style, Price, brand
	Personal	Consider: Self image, personal physical and psychological condition, financial status, experience, knowledge Decide: function, style, price, customization

Figure 3.1 Human Emotional Arousal Channels

Figure 3.2 shows that there are three levels of emotional expression channels of products: visceral, behavioral and reflective.

Level	Appraisal	
	<b>Feature</b>	
Visceral	Style	Color, shape, pattern, symbol, material
	Material	Texture, temperature, hardness
	Smell	Order, aroma, no smell
	Taste	Sweet, sour, salty, bitter, spicy
	<b>Interaction</b>	
Behavioral	Display	Image, facial language, symbol, signal, light, font-size
	Audio	Language, sound signal and music, volume
	Movement	Vibration, flash, forwards, backwards, stop, start and etc.
	Navigation	Map, Voice, logical
	<b>Context</b>	
Reflective	Time	Create: History, experience, memory, knowledge
	Environment	Space, surrounding
	Social	Social norm, Stereotype, Technology, Marketing
	Personal	Restriction, experience, memory, knowledge, interest, goal, criteria

Figure 3.2 Product Emotional Expression Appraisals

Figure 3.3 shows the correlations between product features and users' emotional reactions.

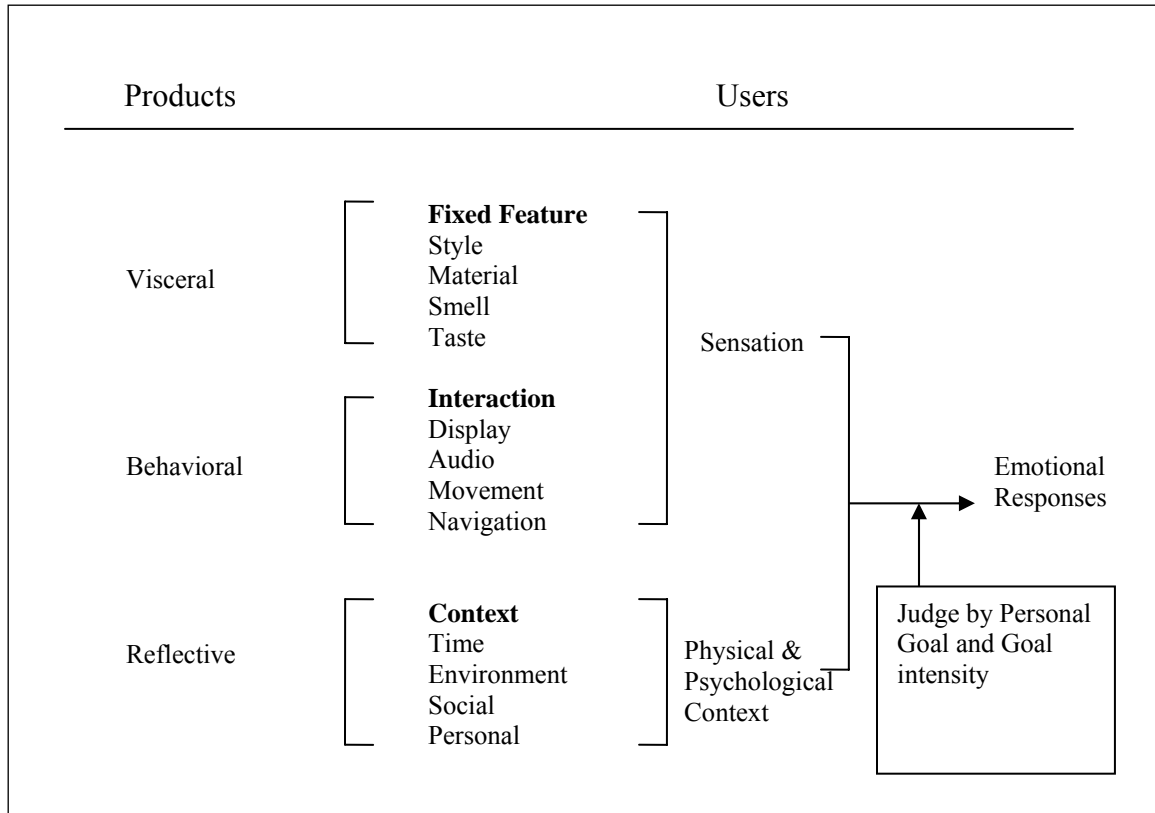


Figure 3.3 Correlations between Product Expression and Human Emotion

### 3.5.2 *Data Analysis Method: Product Emotion Baseline*

A data analysis method called Product Emotion Baseline (Figure 3.5) was developed to help designers test whether a design concept can evoke positive emotions forehead. A product's Emotion Baseline represents the users' evaluation on the listed product features. By comparing the test product emotion baseline with the existing product emotion bottom-line or desired product emotion top-line, designers are able to predict the users' emotional reactions on the listed product features. See details in section 6.3.5.1, figure 6.4.

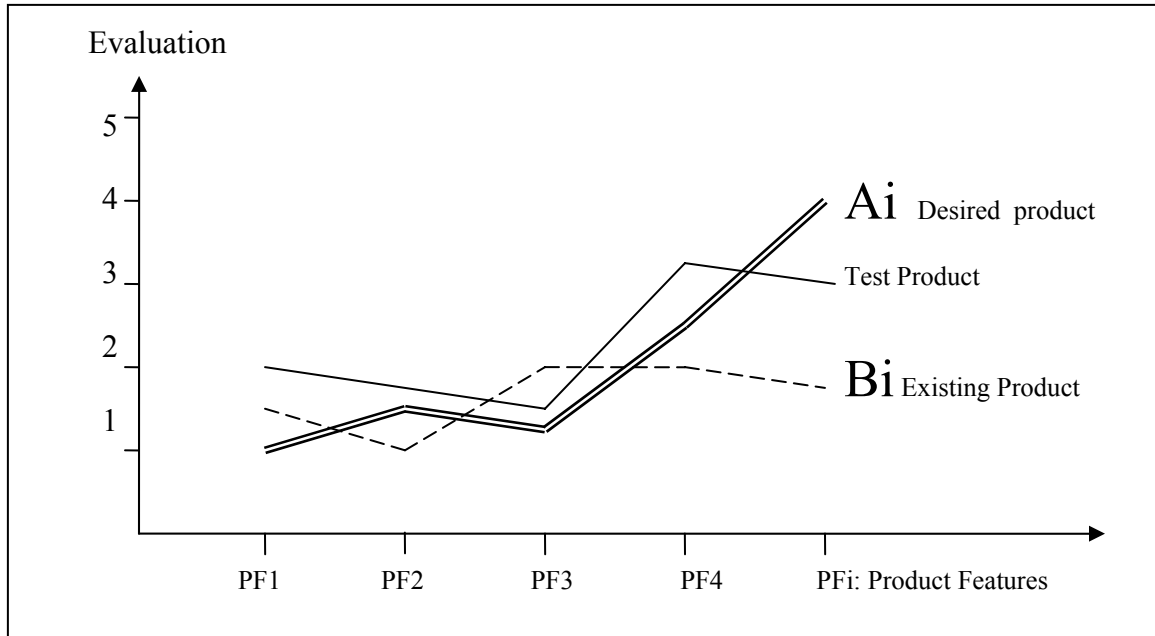


Figure 3.4 Data Analysis: Product Emotion Baseline

### 3.5.3 Data analysis method: Compare Data cross Different Groups

The online survey participants are categorized into three groups: 1) target group – female between 45 and 60 years old; 2) female under 45 years old; 3) male, all age. Therefore, the collected survey results facilitate data comparison between target group users and other group users.



3.5.4 *Data analysis method: Math formula for Calculating Average, Deviation and Delta*

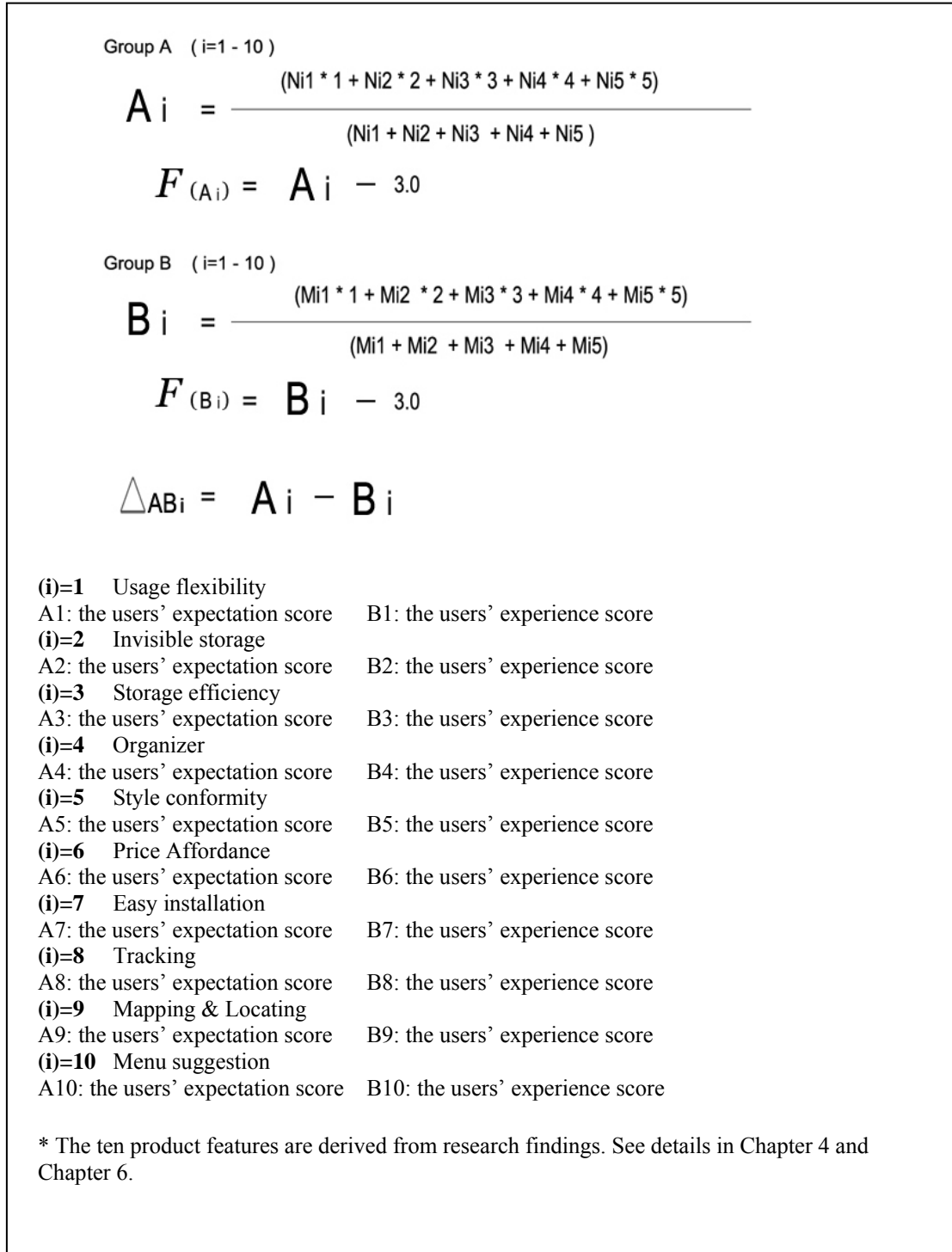


Figure 3.5 Data Analysis: Mathematic Method

(i) stands for the number (i) feature of the product. Here, i is a natural number from (1) to (10). In product emotion baseline, when  $i = 1$ ,  $A_i$  is the users' expectation score and  $B_i$  is the users' experience score on product feature of usage flexibility. N is the number of responses. If  $N_{51}=3$ , it means there are three people that picked choice 1 on feature 5.  $A_i$  is mean user expectation on each product feature (i) of desired products.  $F_{(A_i)}$  is base value of user expectation on each feature (i) of desired products.  $B_i$  is mean user evaluation on each product feature (i) of existing products.  $F_{(B_i)}$  is base value of user evaluation on each feature (i) of existing products.  $\Delta_{AB_i}$  is gap between the expectation and experience on feature i.

# **CHAPTER 4**

## **TARGET USER GROUP**

### **WOMEN AGE BETWEEN 45 AND 60**

In general the mission of product design is to create something useful and desirable. The purpose of emotional design is to attach users' emotion to products, and make products more attractive to users. However, a product is manufactured for a group of users who share many similarities. Typically, personal information such as gender, age, career, physical conditions and financial status are required demographic information that identifies a user group. In emotional design, besides those demographic characteristics, more information about the users is required on their aesthetic taste, life style, physical condition changes and even mental health. A better understanding of the target group from all dimensions is the key to successful designs.

Women who are in the age between 45 and 60 are also known as Baby Boomer women. In United States, Baby Boomers make up the largest generational demographic. Among Boomers, women outnumber men. They are higher educated and better paid than their previous generation. Boomer women are known for their high standard of life. They influence as much as 80% of household purchase decisions, from food and travel to finance and technology. A better understanding of Boomer women will undoubtedly provide designers and companies with a greater advantage in the future marketplace.

Targeting Baby Boomer women has the advantage in emotional design study. First of all, women express their emotions more often than men. Secondly, this is the group of mature women. When people get into middle age, their world view are more

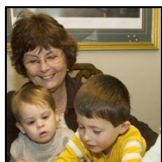
established and stable. Unlike younger woman, Baby Boomer women know what they want and how to get what they want. Thirdly, this group of women is in the physical transition of menopause and psychological transition of empty nest. Finally, many Boomer women have to balance professional work and family activities. Time saving is one of the important criteria for them when it comes to selecting household products.

#### **4.1. LIFE STYLES OF TARGET WOMEN USERS**

##### **4.1.1 *Social Context: Generation Definition & Culture***

Baby Boomer refers to people born in the post-World War II period from 1946 through 1964. The oldest of the Baby Boomers turns 60 years old in 2006. At the same time, the youngest became 42 years old. The estimated number of Baby Boomers, as of July 1, 2005 is 78.2 million. 50.8 percent of Baby Boomers are women. (U.S. Census Bureau, Public Information Office).

The culture created by Baby Boomers transformed America, permeating every decade since the 1950s. The most important thing to remember about boomers is that they are rule breakers. From the peace and free love movements, to the yuppie phenomenon and the explosion of the Internet, the Baby Boomers heralded changes and innovation in all aspects of society.



*"I am definitely a Baby Boomer, in the true sense of the word — the good and the bad." -- Kathleen Casey-Kirschling (the nation's first Baby Boomer — was born in midnight in Philadelphia on Jan. 1, 1946)*

##### **4.1.2 *Life Style Context: Live Younger, Healthier and Happier***

Historically, once a woman reaches the age of 40, society relegates her to a less visible status. However Boomer women often express the feeling that they are entering the most vibrant time of their lives and just hitting their stride (Imago Creative). Their life principle is to live healthier, to look younger and to be happier.

#### 4.1.2.1 Live Healthier: Fitness and Diet

Boomers live healthier because they are better educated, has more money and is more involved in their health care decisions than previous generations. A number of marketing studies show that Baby Boomer women have no intention of adopting the "granny" role or "slowing down" in their senior years -- they intend to remain active, involved and vibrant throughout their entire lifespan. Boomers are three times more worried about a major illness (48%), their ability to pay for healthcare (53%) or winding up in a nursing home (48%), than about dying (17%) (New Retirement Survey, Merrill Lynch). Fitness is one effective way to keep healthy and prevent heart disease which is the No.1 killer to women. As lots of Boomer women exercise on the running machines at home, many choose to join the weight loss training in gyms. They prefer group classes rather than individual training. Along with physical activities, diet is another key factor that affects well beings. Boomer women are fully aware and focused on having a proper healthy diet to prevent diseases like type 2 diabetes, high blood pressure, stroke, breathing problems, arthritis, gallbladder disease, sleep apnea (breathing problems while sleeping), osteoarthritis, and some cancers. The rate of having these diseases increases among middle age people.

#### 4.1.2.2 Look younger: Cosmetic Surgery and Fashion

Boomer women are very resistant to the idea of getting older, and they are using every tool available to fight it. This translates into a wealth of opportunities for products ranging from holistic health and nutritional supplements to exercise and fitness products, from cosmeceuticals to cosmetic surgery, from pharmaceuticals to fashion. Business researcher FIND/SVP forecasts that anti-aging products will turn into a \$56 billion market by 2007, a staggering jump of 50% since 2002. According to the statistics from the American Society of Plastic and Reconstructive Surgeons (ASPRS) cosmetic surgery in this age group increased from 164,000 in 1996, when the first boomers turned 50, to 242,000 in 1998. Meanwhile, U.S. women between the ages of 40 and 58 spent \$27.8 billion on clothing between February 2004 and February 2005, according to NPD Market Research. That's more than women in any other age group. The principle of choosing clothing is to make them look slim, active and elegant in it. According to the marketing trend, companies such as Eileen Fisher, Chico's and Coldwater Creek have spent the last few years in putting out advertisements featuring trim, gray-haired beauties and expanding their lines to attract Boomer women's attention. Gap Inc. recently started a new boomer shopping destination named Forth & Towne.

#### 4.1.2.3 *Stay Young: Menopause and Sexual Life*

The average age of American women at menopause is 51. Menopause is a transition that naturally occurs between the ages of 40 to 55, but some women have experienced the change in the early 30s and as late as their 60s. It doesn't happen all at once. Typically there is a transition period before menopause that is commonly called perimenopause. During this time, the female body begins to produce fewer female hormones. This change in hormone levels causes the symptoms, such as hot flashes,

sudden mood swings, and changes in menstrual cycles. The emotional signs of menopause such as irritability, mood swings, and melancholy are caused by a rise in follicle stimulating hormone (FSH). Boomer women have a positive feeling to their menopause. Fourteen years ago, there was an article on The New York Time, it predicted that Boomer women unlikely their mothers, they would not suffer menopause in lonely silence. They are going to fun away hot flashes, tranquilize jangled nerves and accepting that their best years are behind them (JANE GROSS, The New York Times, May 17, 1992). Instead of secrets, the Baby Boomers crave information about how they can relieve their discomfort and guard their health. These women try all means to keep them active and positive. Their attitudes to sex are different from their moms' too. From The AARP/ Modern Maturity Sexuality Study, women 45 through 59 are much more likely to approve of sex between unmarried partners and less likely to believe that "sex is only for younger people"—than women 60 and older.

#### 4.1.2.4 *Be happier: hobbies and pastime*

Life continues to be an exploration for boomers. That sets up a host of potential services to offer, including special-purpose travel, such as international treks or safaris, whitewater rafting, and wilderness outings; cultural celebrations (e.g. arts forums or festivals); food or culinary adventures (e.g. back-to-the-old-country jaunts or cooking schools). Crafting remains a popular leisure time activity for women throughout their lifetimes.

#### 4.1.3 ***Family Context: Sandwich Generation, Empty Nest and Cohousing***

The other word used to describe this group of women is “Sandwich generation”. The Baby Boomers currently range in age from 42 through 60 and, like middle-aged generations before them, they are in a stage of life when it is natural to give more than to take when it comes to family relationships. Today, though husbands share the responsibilities of housework and children education, the wives still are the persons in charge of some major family activities, such as dining, shopping, and care giving. However, for boomers, changing demographics within families have prolonged the period of being “sandwiched” between the needs of their parents and their children. The nationwide survey conducted by Pew Research Center from Oct. 5 to Nov. 6 among 3,014 adults, including 1,117 boomers, looks at intergenerational relationships within families, found that 71% of today’s boomers have at least one living parent; a majority of boomers (56%) also say it is a responsibility to allow an elderly parent to live in one’s home if the parent wants to move in. On the other side, 63% of boomers report that they have at least one adult child (ages 18 and older), and of this group, about two thirds (68%) say they are supporting an adult child financially, either as the primary (33%) or secondary (35%) source of support.

On the other side, elder boomers are undergoing the changes of Empty Nesting, the stage in life when children move out of their parent's home for good. The Baby Boomer Survey, conducted in April and May 2004 by Del Webb, reveals Boomers have mixed feelings about becoming Empty Nesters. While a large percentage is neutral about the emotional impact, Boomers do feel an increase in freedom to be themselves with Empty Nesting. Getting out of debt is their Number 1 priority when becoming Empty



Nesters. 34% say they will feel closer to their spouse without the children around. 40% of Boomers anticipate that their adult children will move back in with them.

When some people adjust themselves to the emptiness, many are delighted to find that they still have a friend -- sometimes a network of friends -- who is every bit as close as their own brothers and sisters, reports Senior Writer Peg Tyre. Psychologists call the phenomenon "family by choice," and say it is an inevitable -- and healthy -- response to 40 years of social upheaval. Cohousing is a burgeoning movement, with communities all over the country. It's an interesting option for those who want to get back to their hippie roots, redefine community, or just start planning for their second acts (The Cohousing Association of the United States).

#### **4.1.4 *Social Context: "Superwomen" Facing Retirement***

Because of civil rights movement, women have new opportunities in attend graduate school and to pursue well-paid career. 64.7 million women were employed in the U.S. in 2004 (Data source: US department of Labor). 74% worked full time, while the remaining 26% worked part time. More than half of boomers who are not yet retired say they expect to "live very comfortably" (26%) or to be able to "meet expenses with a little left over" (29%) once they retire (Pew research center).

Maryland Journalism Professor Maurine Beasley pointed that "Today young women are presented with a bewildering array of options including the myth of "superwoman" - one who can do everything, have children, rise to a powerful position, even be a glamorous sex symbol, all at the same time." Hillary Rodham Clinton, is a prime example of a "superwoman." She has done all the things that feminists wanted

women to do - get a graduate degree, have a successful career, be a very good mother and successfully run for public office.

Opposite to the middle class women, lower-class women face a burdensome economic struggle. America has more and more single parent families. US census statistics show that there are 9.8 million single mothers in U.S. (1990). Another collaborative study (Baby Boomer Women: Secure Futures or Not?) by the Harvard Generations Policy Program finds that many Boomer women will not have secure retirement futures because of diverse and interrelated demographic, social, cultural, political and economic societal factors (Paul Hodge, Chair, Global Generations Policy Institute, Harvard). Boomers are not saving as much as they should and that their retirement income will be less stable than that of previous generations (MetLife Mature Market Institute). As the policy makers worry about Boomer women's retirement life, boomers view retirement in a more positive light than becoming an Empty Nester. For retirement savings, Baby Boomers overwhelmingly favor large-cap stocks, with these funds comprising 36.9% of all assets measured. Money markets were a distant second at 13.2%, while fixed income was a close third with 12.7% of total assets measured (Clark's Executive Retirement Report).

#### ***4.1.5 Marketing Context: Economic Status & Affordance***

The average annual household after-tax income of boomers is \$58,275 for those 35-44, \$64,080 for those 45-54 and \$55,844 for those 55-64 (MetLife Mature Market Institute, 2005). The estimated annual spending power of the Baby Boomers is more than \$2 trillion. Boomer women is the largest and richest market segment. This diverse group

shares higher discretionary income and the keen scepticism of consumers who have been marketed to (Hope Berschler, Director, Brand Marketing and promotion, AOL, Inc.) . Baby Boomers own 80% of U.S. financial assets and spend 50% of their disposable income. If we project current spending levels to the future, the 55+ households will drive 31% of all-outlet spending in 2015 and 34% in 2030 (ACNielsen). Younger boomers (born 1956-64) spend most of their money on their children and the mortgage. Older boomers (born 1946-55), many of whom are empty nesters, put their money into upgrading their homes and on clothing (MetLife Mature Market Institute, 2005). Boomer households spend an additional \$10,000 more every year on consumer goods and services than their younger cohorts. Boomer women influence 75% - 85% of household purchasing decisions (Imago Creative, see Appendix B.1.8).

#### **4.1.6 *Technology Context: IT Product and Internet***

Women are early adopters; a majority of women buy electronics for themselves, rather than as a gift for others; women are involved in 89% of all consumer electronics purchase decisions (Consumer Electronics Association, CEA survey, 2004). Women have very positive reactions to specific technology areas, like HDTV, cell phones, and digital photography. For example, 48% of women own a digital camera. It was also discovered that 84% of women believe that new technologies can help improve their lives (CEA survey, 2004). When Boomer women shop electronics, they need the product to fulfill both their emotional and functional needs. On one hand, they look for the product features, like sleek, stylish, and simple. On the other hand, a small survey done by Julia Govan, product designer, found the top three priorities in choosing electronics is 1), Trustworthy brand; 2), Reliability; 3), Easy to connect and use. Other potential factors

enhancing boomer technology usage include age-related disability, remote communication to family and loved ones, private institution service changes (such as banks and other commercial services will most likely have a greater enhancing affect on boomer internet use).

In 2004, women aged 35-54 represented the highest proportion of Web surfers, compared with male Boomers and all other demographics (Laura Hnatow, Managing Director at Imago Creative see Appendix B.1.8). When it comes to online activity, Boomer women know exactly what she's looking for. They search the web efficiently — viewing 40% fewer pages than men (Laura Hnatow, Managing Director at Imago Creative). Almost 65% of women rate good design and ease-of-use as extremely or very important qualities in a website. Flash introductions, tiny type and multiple download requirements may be the recipe to attract a twenty-something, but not the Boomer woman. Filtering tools can simplify the web experience and help women get their search results quicker.

#### ***4.1.7 Physical Condition of Boomer Women***

Emotional design does not only care about users' emotional reaction. People cannot detach their emotions from their physical conditions. Both physical and mental health constitutes a person's emotional well being.

##### ***4.1.7.1 Present Physical Problem & Challenge***

Statistics of “The Baby Boomers, New Strategist Publications, 1999” shows — among Boomers, the top five health problems are muscle chest/pains, headache, excess weight, upset stomach and sinus problem.

Table 4.1 Health Problems among Boomers

<b>Category</b>	<b>% Reporting Problems</b>
Muscle chest/pains	37%
headache	37%
excess weight	35%
upset stomach	31%
sinus problem	31%

Although Boomers vow to stay younger and feel younger, aging is a natural and inevitable biological process of human body. The changes brought by aging effect on vision, hearing, memory function, mobility and dietary. Many Boomer women are undergoing a major body changing – menopause. The slowing metabolism could cause gaining weight and less active. Normal aging or menopause changes will not cause serious physical problems. However, drugs or alcohol addict, smoking habit and eating disorder could cause more serious health disease and even death. The Drug Abuse Warning Network (DAWN) publishes findings on drug related mortality. DAWN found that in 30 metropolitan areas, more than half of all drug misuse deaths happened to those aged 35 to 54. According to National Institute on Drug Abuse (NIDA), women are more at risk for prescription drug abuse because they're more likely to be prescribed an addictive drug, such as an opioid or anti-anxiety medication. In 2002, 38% of younger Boomers (aged 35 to 44) and 31% of older Boomers (aged 45 to 54) were current users of some form of tobacco.

Women of all ages are very conscious of their bodies. Center of Disease Control (CDC) statistics show that more than 60% of the population is either overweight or obese. A lot of women gain weight in their midlife, the weight tends to accumulate around the

stomach, rather than hips and thighs. Overweight causes high blood pressure and high cholesterol which increase the risk of heart diseases and strokes. So many women choose unhealthy diet in order to keep in shape. About 1% of women – including 30% of those who seek treatment to lose weight – have being eating disorder. The most common eating disorders are anorexia nervosa and bulimia. Compulsive overeating is the opposite kind of eating disorder. Eating disorder usually reflects more psychological problems than physical problems. Boomer women may eat excessively due to stress of divorce, parenting problem, lost love ones, career difficulties, financial strain, empty-nest syndrome, emotional and physiological changes brought on by menopause, fears associated with aging, or desires to look younger (Public Broadcasting, PBS). Some studies suggest that nearly 80 percent of anorexia-related deaths occur in women who are over the age of 45.

#### 4.1.7.2 The Decrease of Physical Ability in The Future

In 2006, Baby Boomers will begin to turn sixty and in 2011, sixty-five. In the coming decades, there will be a significant increase in the number of elderly boomers and in their proportion to the total population. From 2010 to 2030, the 65+ population is projected to “spike” by 75% to over 69 million people. By 2050, the 85+ group will rise from a current 1.4% to comprise about 5% of the population. Most of the 85+ will be widowed women (U.S.DHHS, U.S. Administration on Aging, Statistic).

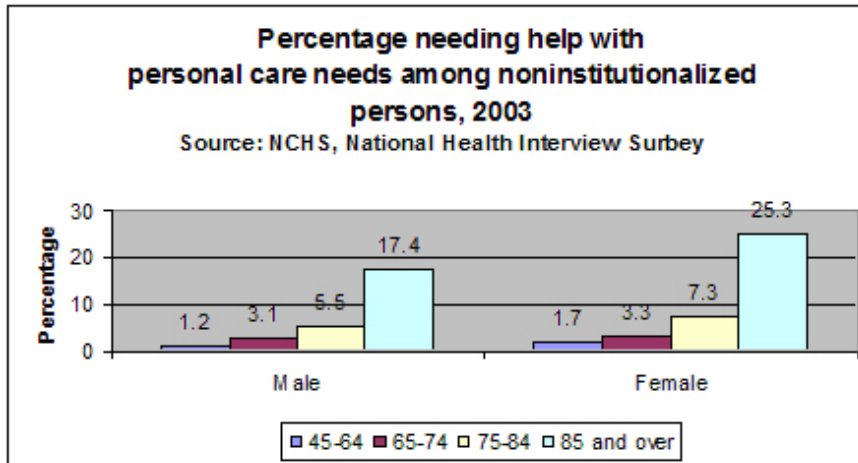


Figure 4.1 Percentage needing help with personal care needs among noninstitutionalized person, 2003

Disability significantly affects quality of life in old age. Nearly three out of four Americans over the age of 80 had a disability in the form of a limitation on a basic functional activity in 1997. Types of disability frequently considered among the elderly include limitations in general functioning (such as walking or climbing stairs); managing a home; and personal care. In addition to the consequences of the normal aging process, chronic diseases can also cause disabilities. The National Institute on Aging statistics, in 1998, 69.2% of Medicare beneficiaries 65 and over had trouble stooping; 45.6% had trouble walking; over 30% reported having difficulty with heavy housework; about 18% reported difficulty with shopping; about 38% reported had trouble reaching; about 30% reported had trouble grasping and reaching. Mental health problems – especially dementia – can also cause the elderly to lose independence. Compare to men, elderly women reported more difficulties in doing heavy housework, preparing meals and shopping.

## 4.2. RESEARCH FINDINGS

### 4.2.1 *Findings of Interview*

There are 7 people participated in the interview. They are all female, aged between 45 and 60. Three of them work as part-time, and four of them are working as full-time. Three live only with their husbands. One lives with an adult child. One lives with her husband and teenage son. One lives with her husband and one 7-year-old son and one teenage son. And the other one lives with her husband, teenage daughter and mother-in-law. Their occupations are nurse, cashier, accountant, medical researcher, IT manager, and small business owner. Here is the summary of the findings from the interview (Details in Appendix A interview notes).

- 6 out of 7 of participants were home owners. Among them, 5 out of 7 had been living in current houses from 5 to 10 years. 6 out of 7 lived with husband; 4 out of 7 lived with children; just 1 person lived with mother-in-law; and 1 person took care of grandchildren.
- They described their financial status as “comfortable”, “but could be better”
- They described their current life style as “busy”, “healthy”, “stressful”, “disorganized”; all the participants thought their life were some to degree “busy”. Their stress was coming from “teenager children”, “husband”. They all looked at themselves as being active and healthy.



- Green, blue, yellow, white and cream were the color they loved to have for their kitchen wall. All of them liked wood material for kitchen cabinets. Open kitchen and closed pantry were favorable.
- 6 out of 7 participants owned computers at home. 5 of them have desktop PC, and 1 has an apple laptop. They used their computers for work, surfing internet, banking and playing music. Those owned computers had internet access and used internet for reading news and fun websites, searching for recipes, online shopping, booking trips and hotels, and online banking.
- 6 out of 7 participants owned a cell phone. All cell phones were flip cell phones.
- Reading was the No.1 hobby for them after work; Watching TV was No.2. Spending time with kids or pets, gardening, computer, craft, weight control were other things that they liked to do after work.
- Only 3 out of 7 participants said that they enjoyed shopping. Only one reported that she did shopping on every weekend. The other 4 out of 7 participants did not like to shop. The reasons were: too noisy and crowded in mall; feeling frustrated when she couldn't find what she wants; not interested in clothing now; like window shopping; mall is teenager's place.
- 6 of 7 participants liked cooking. They liked to cook desert or holiday dinner, and they like to try new dishes. The only one said she did not like cooking because she had to cook a lot. She felt that she was obligated to cook everyday.

- All of the participants used either recipes or cooking books. Some collected recipes from family members, friends and grocery stores. Some went online searching for recipes.
- They shopped grocery once a week. 3 out of 7 shopped grocery more than twice a week because they like fresh food. 5 out of 7 participants check their pantry before shopping. Only two made shopping lists. Two people said that they had very good idea about what's in their pantry. They did not need a shopping list or list for storing stuff. In average, each family used the pantry 7 times a day. No relationship was found between the size of the family and frequency of usage.
- All participants were the person either primary or secondary in charge of grocery shopping. 2 out of 7 report that their husbands shared the responsibility of grocery shopping. One participant said that she was also responsible for grocery shopping for her sons' families.
- 4 out of 7 did not feel that they have enough grocery storage space in the pantry. They used the laundry room, basement, garage, kitchen islands and kitchen cabinets as a supplemental space for storing grocery.
- Two participants said that they had problems reaching the top shelves because they were short. One participant said she wanted a pantry to be able to fit different family member's time schedule. Her son was a picky eater and she did not prepare enough meals. Although most participants were far eye-sighted and many of them were both far eye-sighted and near eye-sighted, just one said that she could not see the label on the package clearly. Two participants had problems locating items.

- The biggest problem for grocery organization was space. The second one was time. Although most people were confident that they can do organize well, they did not do it as they said.

#### 4.2.2 *Findings of Online Survey*

There are 71 people participated this online survey. Online survey participants are categorized into four groups:

- 1) Target group – female between 45 and 60 years old (Baby Boomer women): 23 participants
- 2) Female under 45 years old: 21 participants
- 3) Male: 25 participants

The following findings are focused mainly on the target group. Detail results in Appendix A online survey results.

- 65% of target group participants had full-time jobs and 13% had part-time jobs.
- 26% of target group participants had been living in their current house for more than 15 years, and 17% of participants for under 5 years.
- 73% of target group participants lived with spouse, 13% lived alone, and 17% lived with other such as sister, friend, boyfriend, etc. Just 5% lived with parents. 22% target group participants lived with children, compared to 35% of all participants lived with children.

- Compared to the other groups, the target group reported the least busy and least stressful of their lives (figure 4.2 life style).

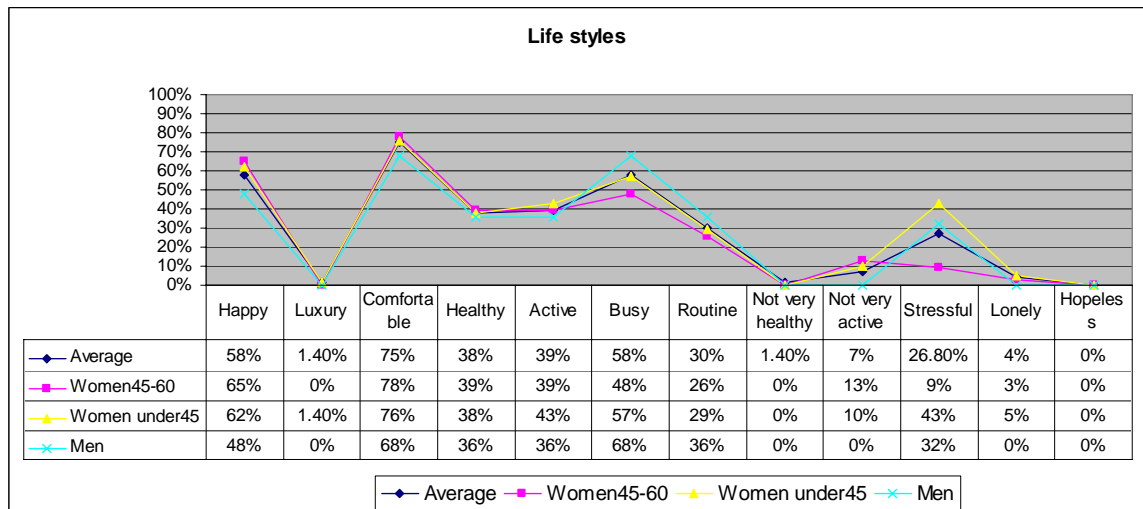


Figure 4.2 Life Style

- Compared to the other groups, the target group participants spent more time on gardening, reading and cooking. They spent the least amount of time on outdoor exercising, traveling and socializing. An interesting fact was that, 52% of women participants under 45 loved shopping, however, just 17% of target group participants regard shopping as a hobby (figure 4.3). However, all groups had similar favorable opinions of grocery shopping (figure 4.4).

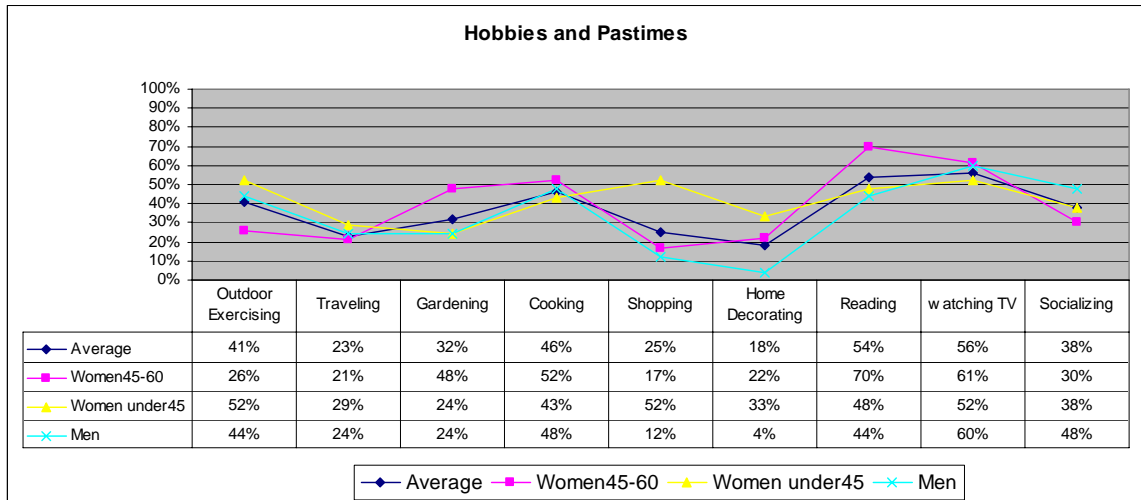


Figure 4.3 Hobbies and Pastimes

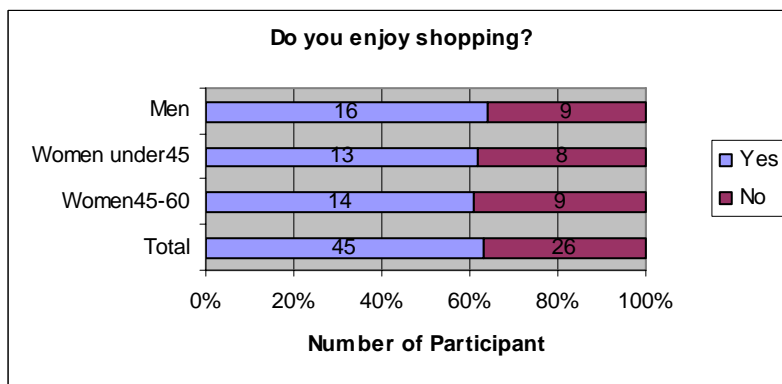


Figure 4.4 Enjoyment of Shopping

- 83% of target group participants and 75% of all participants shopped groceries every week.
- 22% of the target group participants reported Problem with arthritis. 30% of target group participants reported visual problem. 9% of the target group participants reported problem with memory.

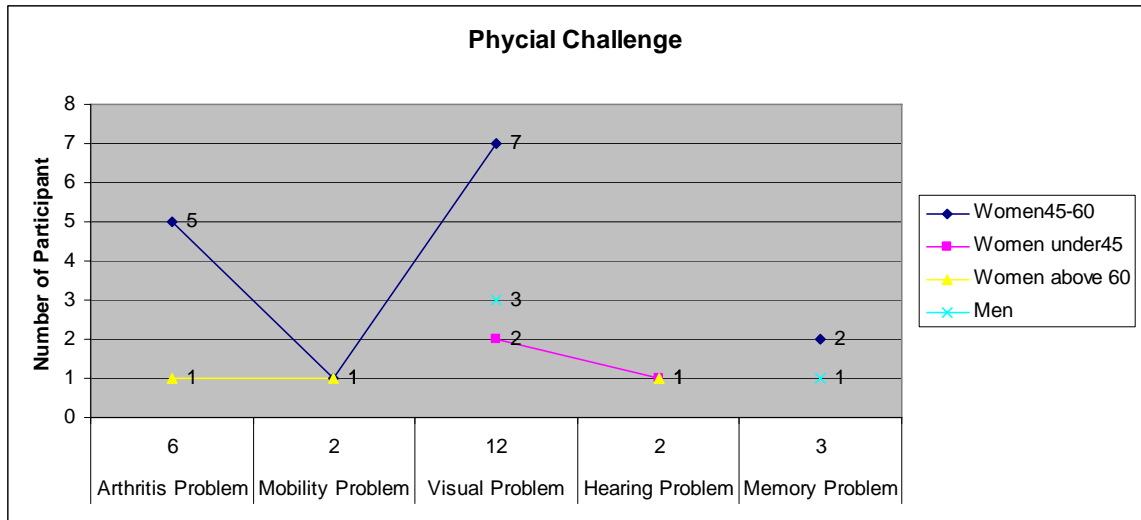


Figure 4.5 Physical Challenges

- About 58% of the target group participants had online shopping experience, comparing to 86% of men and 66% of all participants (figure 4.6).

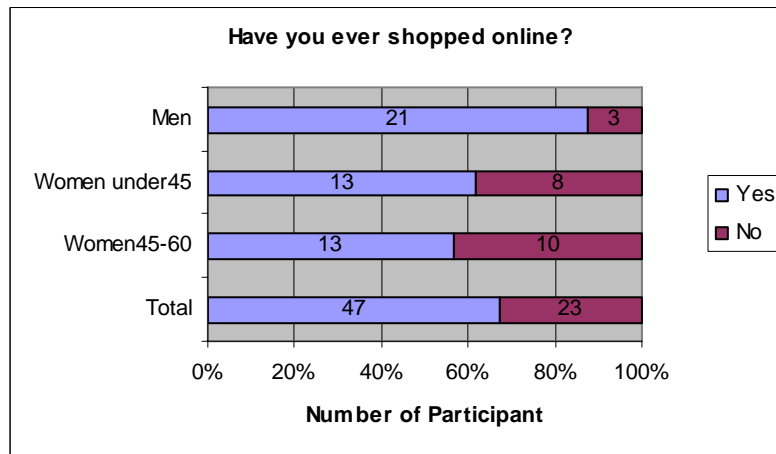


Figure 4.6 Distribution of Online Shopping

- A higher percentage in people in the target group participants used recipes or cooking books to cook than any other group (figure 4.7). A higher percentage in the target group participants owned a cell phone than any other groups (figure 4.8).

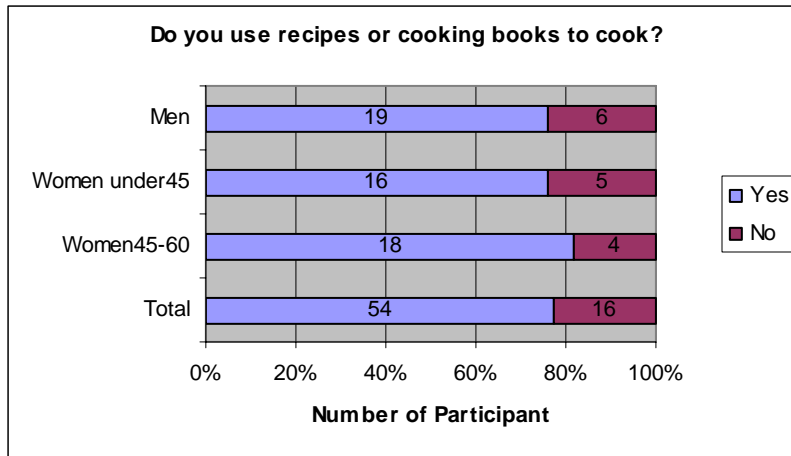


Figure 4.7 Cooking Habit

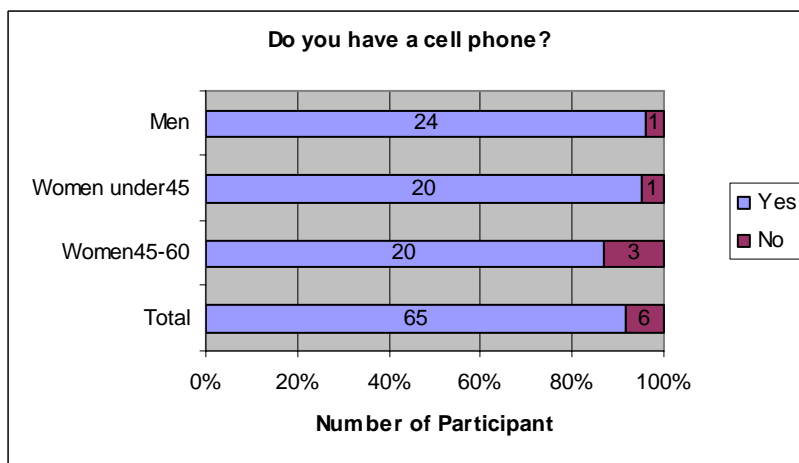


Figure 4.8 Distribution of Cell Phone

- Only 48% of married women in the target group participants reported that their spouse share the grocery shopping, however, 76% of married male participants said their spouse shared the responsibilities (figure 4.9). 20% of married target group participants reported that their spouse helped on grocery organization, compared to 70% of married men said that they shared the responsibilities with their spouse (figure 4.10).

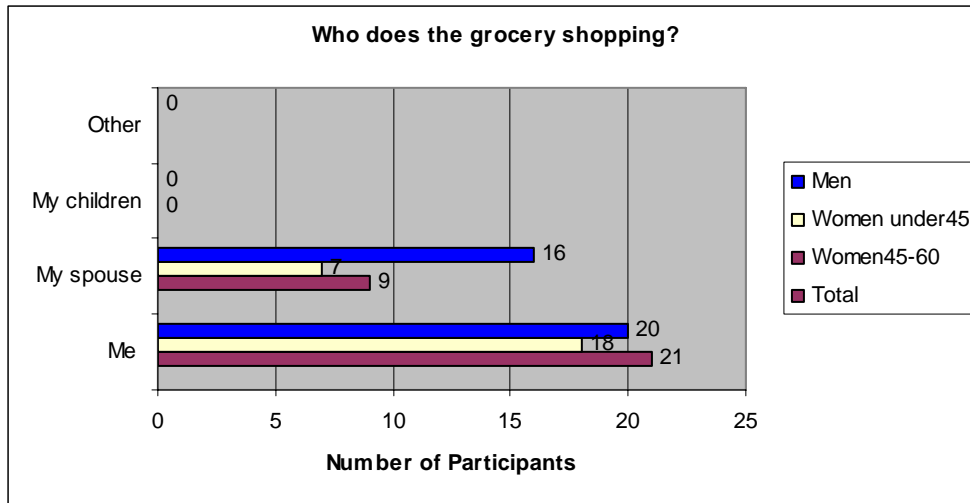


Figure 4.9 Grocery Shopping

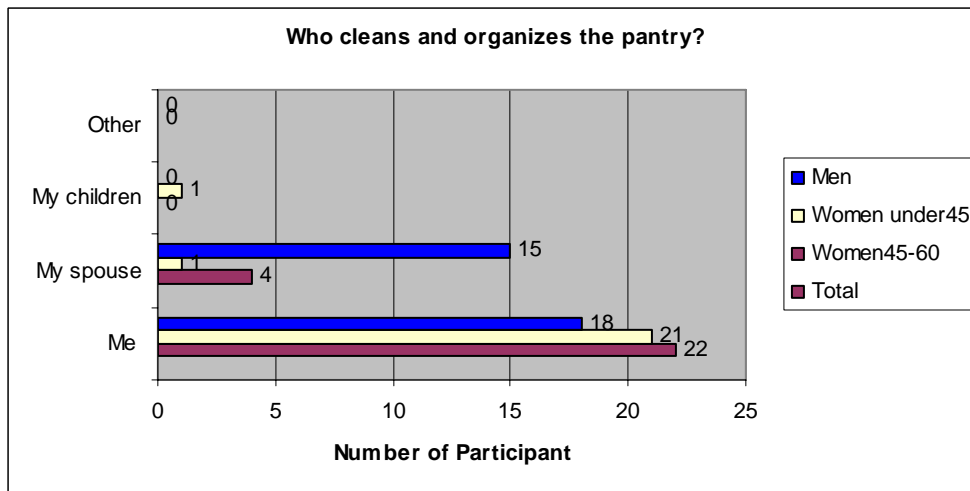


Figure 4.10 Grocery Organization

- Fewer than 26% of all participants and 22% of target group women used labels or checklists to help them organize and track grocery inventory.
- 100% of target group participants and 93% of all participants organized their groceries by types; 22% of target group participants and 21% of all participants organized by sizes; 8.7% of target group participants and 8.5% of all participants



organized by purchase dates: and 8.7% of target group participants and 7% of all participants organized by family members.

- When it came to making decision with product purchase, function was number one consideration (94%), price was number two (54%), and look was number three (32%). Very few people cared about the brand (figure 4.11).

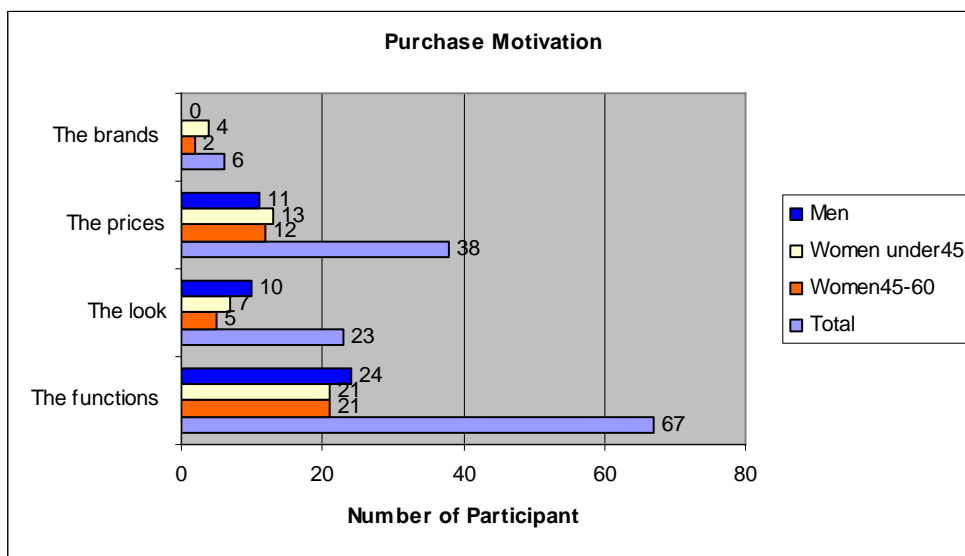


Figure 4.11 Purchase Motivation

### 4.3 GROCERY STORAGE HABITS OF THE TARGET WOMEN USERS

Table 4.2 Grocery Storage Habits of Target Women Users (45-60)

	Target Group	Spouse	Children	Parents	Others	Notes
Who does the grocery shopping at home?	♥	♥			♥	Average every week; two or more times a week if someone like fresh food
Who cleans and organizes pantry at home?	♥	♥	♥			After grocery shopping
Who does the cooking at home	♥	♥			♥	Almost every day
Who checks the pantry inventory at home?	♥	♥			♥	Before shopping
Who uses the pantry?	♥	♥	♥	♥	♥	Many times a day
Who makes decisions to buy pantry storage products?	♥	♥			♥	

#### 4.4 EMOTION APPRAISALS OF THE TARGET WOMEN USERS

Category		Appraisal
Sensation	See	Stylish; earth tone color, see through, wood surface, high quality
	Touch	Warm, smooth
	Hear	(Human Voice guide or reminder)
	Smell	No order, smell clean
	Taste	Keep food taste fresh
Physical Context	Time	Keep food fresh, easy cleaning, save time on organization
	Space	Save storage space, stackable; use space wisely, adjustable; connection between different storage space
	Surrounding	Multi-user environment; closed from the outside, low temperature, low humidity
Psychological Context	Social	Share recipes with family and friends; holiday dinner cooking; cost effective
	Personal	Cooking for fun; eat healthy; balance nutrition; look young and beautiful;

Figure 4.12 Emotion Appraisals of Pantry Storage Product for Target Women Users (45-60)

## **CHAPTER 5**

### **PANTRY STORAGE PRODUCTS**

#### **5.1 HOME GROCERY STORAGE AND ORGANIZATION**

##### **5.1.1 *Home Grocery Shopping and Storage***

Americans follow the buying-in-bulk habit. Instead of visiting the general store on occasion for large quantities of flour and sugar, households shop every few weeks at discount warehouse stores, and purchase large bags of foods and house supplies. Based on a consumer survey, US households shop grocery once a week in average. In the countryside, specially at winter time, family might store more food. The Mormons believes well prepared, and it encourages people to prepare several months of food supply at home. The majority of groceries need to be stored at home are various foods and household supplies. People store their foods and household supplies at different places in the house, such as kitchen, pantry, refrigerator, freezer, laundry room, basement, and even garage. The pantry is dedicated to grocery storage. People like to keep groceries in the pantry because it is close to kitchen. Through this research, It was founded that majority of people like to store their groceries by type or size. The first step to the design of the pantry storage product is classification of categories of groceries.

##### **5.1.1.1 Type of Grocery**

In general, groceries stored at home can be classified by type to the following: fresh foods, preserved foods, cooking material, drinks and wines, health supplies and house supplies. Fresh food consists of fresh meat products, dairy products (except dried and canned), poultry, fish and seafood products, bread and baked goods, fresh fruit and

vegetables. Fresh food needs to be stored in a temperature controlled area, such as a refrigerator. Usually, fresh food needs to be consumed within a short period of time. On the other hand, preserved foods are easier to store and can last relatively longer than fresh food. Preserved foods are canned food; air-tight packaged food, frozen food, and dry food. Drinks include soft drink, bottled water and other beverages. Cooking material is a big category. It includes flour, sugar, salt, paper, oil, vinegar, source, marinate, all kinds of flavors and spices. Health supplies include vitamins, dietary supplies and medicines. House supplies include dinnerware, cookware, silverware, paper and plastic products, household chemicals, laundry and dry cleaning supplies, and toiletries.

#### 5.1.1.2 Grocery Packages & Food Labels

There are several typical shapes and materials of packages for different types of groceries: rectangular paper or plastic box (for cereal, pasta, cookie, juice, detergent, etc); Cylindrical aluminum, iron, or paper foil can (for soft drink, canned soup, peanuts); Large glass or plastic bottle (wine, beer, oil, source, jam); Small plastic bottle (for drug, dry herb); Plastic or paper bags (for flour, paper tower, toiletries, chips, rice); no package (watermelon).

People can find Bar Code on almost every package. Barcodes are automatic identification technology. It allows data to be collected accurately and rapidly. A Bar Code symbol consists of a series of parallel, adjacent bars and spaces. It has been used in super markets since 1970.

Since 1994 food manufacturers have been required by the Food and Drug Administration (FDA) to include food labels (or Nutrition Facts labels) on product

packaging so that consumers have accurate nutritional information about the food they purchase. However, food labels are more than just a federal requirement once people understand the information that labels provide. People can use food labels as a guide to planning healthier meals and snacks.

Figure 5.2 provide assistant to understand food labels and serving sizes. At the top of the label under “Nutrition Facts”, there is the serving size and number of servings in the package. The rest of the nutrition information in the label is based on single serving. Those percentages which are highlighted by purple refer to the percent daily values (%DV). Percent daily values show the nutrition capture contained in a single serving with the comparison to the total need for the entire day.

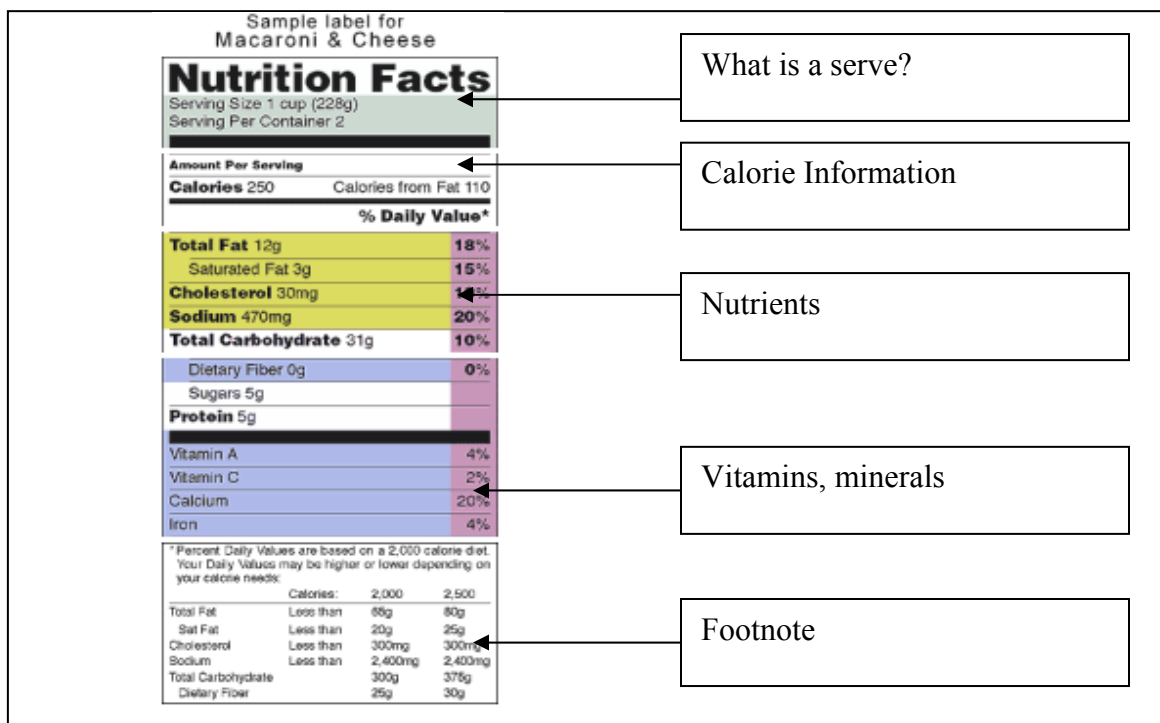


Figure 5.1: Food Labels

In addition to the Nutrition Facts labels, the FDA also regulates the use of phrases and terms used on the product package. A list of common phrases a consumer may see on the food packaging - and what they actually mean – are listed below:

- No fat or fat free: Contains less than 1/2 gram of fat per serving
- Lower or reduced fat: Contains at least 25 percent less per serving than the reference food. (An example might be reduced fat cream cheese, which would have at least 25 percent less fat than original cream cheese.)
- Low fat: Contains less than 3 grams of fat per serving
- Lite: Contains 1/3 the calories or 1/2 the fat per serving of the original version or a similar product
- No calories or calorie free: Contains less than 5 calories per serving
- Low calories: Contains 1/3 the calories of the original version of a similar product
- Sugar free: Contains less than 1/2 gram of sugar per serving
- Reduced sugar: at least 25% less sugar per serving than the reference food
- No preservatives: Contains no preservatives (chemical or natural)
- No preservatives added: Contains no added chemicals to preserve the product.  
Some of these products may contain natural preservatives
- Low sodium: contains less than 140 mgs of sodium per serving
- No salt or salt free: Contains less than 5 mgs of sodium per serving

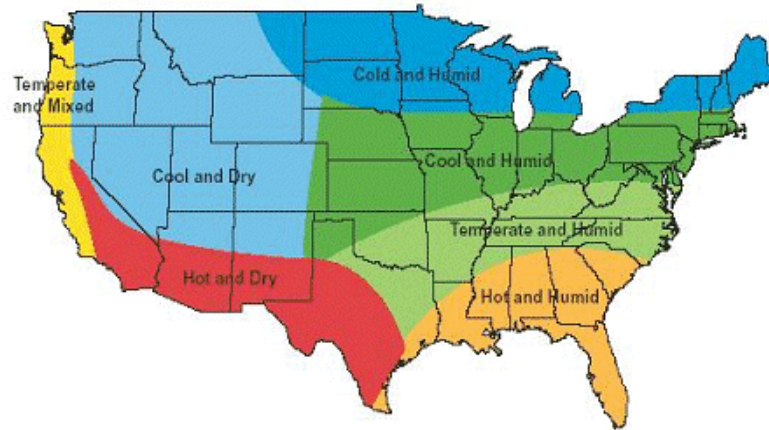
- High fiber: 5 g or more per serving (Foods making high-fiber claims must meet the definition for low fat, or the level of total fat must appear next to the high-fiber claim)
- Good source of fiber: 2.5 g to 4.9 g. per serving
- More or added fiber: Contains at least 2.5 g more per serving than the reference food

#### 5.1.1.3 Condition of Grocery Storing

Food storage makes up the majority part of grocery storage at home. To keep foods at their best quality, it is important to store them in clean, dry, cool (below 85 F) areas away from the stove or the refrigerator's exhaust. Temperature is the most important condition for food storage. Most health and household supply can be kept under room temperature. Although canned goods, cereal, baking mixes, pasta can be kept at room temperature, extremely hot (over 100 F) and cold temperatures are harmful to these goods. Vegetables, meat products, baked products and dairy products have to be kept in cool temperature. Freezing can be used to extend the life of many products. Another important condition is humidity. Most U.S. houses do not install moisture control if they are not in the dry area (Figure 5.1). However, humidity control is very important. For an instance, humidity levels greater than 60% may cause dry foods to draw moisture, resulting in caked and staled products. The third important condition is time. Proper temperatures and humidity can keep food fresh and inhibit the growth of most bacteria. However, food spoilage microorganisms can still grow and multiply slowly over time, so there is a limit to the length of time that foods will stay fresh.



General recommended storage times for various food products provided in the table Food Storage and Time (Appendix B.3.3). In addition, medication and chemicals go bad or lose effectiveness after the expired date.



Source: United States Environmental Protection Agency [www.epa.gov](http://www.epa.gov)

Figure 5.2 U.S. Humidity Map

### 5.1.2 *Home Grocery Storage Problem*

#### 5.1.2.1 Insects

Insects seek heat, moisture and dark places to live and lay eggs. Storage areas are one of their favorite places. In dealing with insects, households should 1) keep food in closed containers or air-tight plastic bags; 2) store food or items 6 inch above the floor; 3) use safe pest control products.

#### 5.1.2.2 Bacteria & Molds

Bacteria cannot be eliminated, however, they can be controlled. Like any other creature, bacteria need a combination of food, moisture and proper temperature to

survive. By regulating the availability of each, families can take a big step to keeping bacteria under control. Molds can grow on almost anything, especially where there is moisture. An effective way to prevent mold is to control moisture.

#### **5.1.2.3 *Pets & Little Kids***

People don't want their kids or pets to wonder around the pantry, mess with the food or eat foods they are not supposed to eat. So it is very important to keep pantry doors closed and certain food, medicine and household supplies out of little kids' reach.

#### ***5.1.3 Home Grocery Organization***

Home grocery organization is a process of purchasing, categorizing, storing and tracking groceries. The purpose of managing this process is to save money, time and storage space. Choosing the right organization product can save people extra time. From the conducted survey, it was found that although everyone wants a neat well-organized pantry, not many people really spend their time to follow the steps. Users rely heavily on their own memory to remember all the storage information.

There are several steps that need to be done before people can get organized. First step is to clear available storage locations. Second is to gather information about storing purposes and items. Third is to choose and use the right storage products. Most importantly people need to keep good organizing habits and use some auxiliary tools. A shopping list or a storage list can relieve people's burden on memories. In addition, some software tools and gadgets are designed to make the home organization process much easier and more fun.

#### 5.1.4 *Home Grocery Organization Problem*

From interviews, it was learned that some people complain that their pantries are disorganized, but they do not think they would change the situation regardless if they knew organization tricks. It reminds us that home storage and organization problems are caused by both objective and subjective reasons. On one side, grocery organization is difficult because they come in different sizes, types, packages and dates. So, it is a time consuming job for individuals to classify everything every time. However, people are not willing to enforce good storage habits. For example, one of the interviewees said, “I don’t know if I would follow the instructions, I just don’t see I can keep doing it.” Another reason is some people are inclined to keep items and not get rid of things. They keep items even though they have not been used them for years. Expired canned food is also kept, and might be eaten by mistake.



### 5.2 **RESEARCH FINDINGS: EXISTING PANTRY STORAGE PRODUCTS**

#### 5.2.1 *Product Review*

Among thousands of storage products currently available on the market, there are mainly five categories: cabinet & draw; shelf; container & basket; box & bag; jar & bowl. Besides these five categories, smart scanner systems are also available in the electronics and appliance stores. It works to help people organize and track groceries based on the product barcode technology.

##### 5.2.1.1 Cabinet & Draw



Cabinets and draws are widely used in some up-scale pantry. The price range for this kind of wood cabinets range between \$39.99 and \$199.99, and average around \$100. Customized wood cabinets with installation for a walk-in pantry can cost up to several thousand dollars. Heavy duty metal cabinets are usually used for garage storage not for pantry.

#### 5.2.1.2 Shelf



White wire shelves are preferred by builders. There are a couple of size choices available, 18", 16", 14" and 12" in depth; capacity is 600-800 lb per shelf; about \$6 per foot. All interviewees of this research complain that because of the space between wires, wire shelves do not present a stable storage option. Although the majority of shelves are fixed, some are movable. Movable shelves are not preferred, because the wheels cause damage to hard wood floors.

#### 5.2.1.3 Container & basket



Today's containers and basket are well designed and manufactured. Every family can find a right product with the right price for them. Plastic containers are widely used because they are durable, light-weight, and able to be seen through. Rubbermaid™ and Ziploc™ are the two largest plastic container manufactures in today's market. Foodsaver™ specializes in air tight containers and vacuum products. Depending on the interior styles of pantries, some people choose traditional styled wicker or glass baskets; and some people may choose contemporary design metal wire baskets. All of them have various sizes and color choices.

#### 5.2.1.3 Box & bag



Both boxes and bags are good for grocery storage. Processed or preserved food come with the packaged boxes which can help food last longer. Most grocery stores offer plastic or paper shopping bags.

#### 5.2.1.4 Jar & bowl



Jars and bowls are used to store loose items such as sugar, salt, and spices. Crafted wood, crystal glass, stainless steel and painted ceramic jars increase the aesthetic appeal of the storage products. However, they are more expensive than plastic containers or paper boxes.

#### 5.2.1.5 Smart Product



*Kitchen Companion* is the leading smart barcode scanner for home organization products. It features many functions from one-scan shopping lists to nutrition and recipe management. It comes with a database of over 300,000 grocery items, along with nutrition data from the United States Department of Agriculture (USDA). Scanned information can be downloaded to a personal computer, Mac, personal digital assistant or a cell phone. This product is small, portable, and easy to use. It is currently priced at \$279 (a USB version is \$179).

### **5.3 RESEARCH FINDINGS: TARGET GROUP'S PANTRY STORAGE PRODUCT PREFERENCE**

- 100% of target group participants had shelves in their pantry; 43% had cabinets; about 70% used containers or baskets; 35% used packaging boxes or bags. The target group women used more containers and baskets than packaging boxes and bags.
- They listed the good features of existing products were air-tight, washable, stackable, see through, easy to open, fit well, and display well. The bad features were irregular shape, not stackable, blocked view, not adjustable, gap between the wire shelves. No one had done any changes to existing pantry furniture what came from the builders.
- 100% of the target group participants agreed that function was the most important aspect of a pantry storage product. 43% of participants thought their current product were functional. 43% chose "okay". 14% disagreed.
- Half of the participants though that their pantry storage product were not visually attractive to them. Most people wanted a closed pantry.
- Participants had never used any computer software to help them organize their pantry. 57% liked the idea. One person preferred PC program, another preferred integrated monitor on the pantry door, still another preferred TV remoter or portable remoter.

### **5.4 SMART PRODUCT AND EMOTION**

Information technology and ubiquitous computing changes our life every day. Technology is becoming an increasingly indispensable element of everyday life. Smart products created from the information society, access information resources through

versatile networks, and provide valuable services and utility functions. They provide society members, be their “consumer” or “producers” with previously unforeseen possibilities for intellectual and emotional activity, exploration, personal and organizational development, and welfare (Kari Leppala, Mikko Kerttula, Tuomo Tuikka, virtual design of smart product, 2003).

#### **5.4.1 *Product Design Trend for Smart Product***

Today, the most significant technology trend is associated with the miniaturization of electronics components. Thin, light and chic looking products are more and more favorable in today’s market. People will get accustomed to computing product just like they get used to TV, refrigerator and microwave. Another trend relates to people’s demand for simplifying life styles. As a response to this demand, compact design was introduced. Mobility is another trend in all lines of consumer products. WiFi (Wireless Fidelity) and Bluetooth technology allow portability of everyday computing applications. An example is the evolution of mobile phone. The first generation of mobile phone is analog phone. It was introduced in the US at the end of the 1970s. The second generation is 2G phone. 3G phones (third generation) which were deployed in Korea and Japan in 2000 and 2001. The 3G networks technology heralds the revolution of a handful mobile device. The new generation of cell phones seems to be a combination of phones, PDAs, global positioning systems, digital cameras, handheld gaming devices and mobile controllers. Toshiba has developed software to remotely operate a PC using a mobile phone over a cellular network. (Computer World) There is another European telecom company that offers similar telephone control technology. As long as users register their telephone number or cell phone number with the company, they will be able to change



their telephone to a remote controller of your home PC. Meanwhile, WiFi technology boasts faster data transfer speeds and range, making it a good replacement for Ethernet systems, while Bluetooth requires less power and is therefore more prominent in small appliances, such as PDAs. Nokia developed a micro-transfer technology which allows two cell phones share the same information. (Discovery Channel) For example, it is not requires to go through the text message services, a contact will be sent another cell phone with the new Nokia phones. As simple as people put two cell phones back to back, one second later information is transferred.

#### ***5.4.2 Virtual Space and Smart Product***



Virtual space is a computer-generated, three-dimensional representation of a setting in which the user of the technology perceives themselves to be and within which interaction takes place (dictionary.com). Smart products connect the consumers with information which creates the virtual world within where people can see, listen, talk and even experience emotions. Virtual world is not a physical world but part of the real world. For an example, the notebook at left is a traditional product. The laptop on the right, it is also called “Notebook”, but it is a smart product. A person uses the old version of notebook to write a shopping list. He or she has to carry the notebook with them to the stores and bring it all the time in case there is anything changes. People don’t like this

way of organization. However, by using “smart notebook” and Internet, the grocery information can be updated remotely and automatically. Users can access to their data around the world without being limited by time and space. Moreover, they can also shop at online grocery stores. The stores will deliver the orders right at the doors.

Human and smart products emotionally interact with each other across and between the real world and the virtual world. The users’ emotional reactions to a smart product happens in the real world; the product emotions are presented in both real and virtual world.

#### ***5.4.3 Relationship between AI Product and Emotion***

As discussed in chapter 2, product emotions are embedded into products by design practice at purpose. The products cannot generate emotion by themselves. However, advanced technology allows products to react users’ emotion. The term “context awareness” indicates a situation in which a smart product or application interprets the user’s situation and emotion, and provides the user with meaningful options and alternatives. The products are context aware, because products contain the software which can capture, compare and respond to the emotional appraisals under the contexts.

The ultimate AI machine could exhibit human intelligence and behavior. It is also capable of learning and adapting through experience. When this happen, users will not be able to detect that they are interacting with a machine instead of a person. Currently, industrial designers are visually aware of product features such as its shape, color or texture, and to expect certain emotion response. Product functionality allocation and product behavior design is another higher level of emotional design. However, all these

emotions carried or presented by the products are not initiated by product themselves. Since the products come off product lines, their attached emotions from designers' interpretation are fixed. With regards to AI product design, product visual elements or functional behavior are not enough to develop the devices' emotions. AI designed products are also able to learn and adapt through product experience. So they can adjust themselves to react more accurately.

## **5.5 EVERYDAY COMPUTING AND SMART HOME**

### **5.5.1 *Everyday Computing***

The micro-definition of everyday computing is the technology related to personal computing. The macro-definition of everyday computing is interpreted by a handful of researchers as leveraging computational capabilities to enhance day-to-day activities in a continuously present environment (Everyday Computing Lab, GT). Everyday computing activities include organizing tasks, managing information and communicating with family and friends. Related to its definition, everyday computing has several specific features: 1) daily activities rarely have clear beginnings or endings; 2) interruption is to be expected; 3) multiple activities act concurrently; 4) time is an important discriminator; 5) associative models of storage are required; 6) using natural interfaces to support communication and background. PCs, laptops, calculators, PDAs, cell-phones, digital cameras, music players and ATM machines are example of everyday computing products. The day-to-day computing needs of home users have evolved from basic e-mail, Web browsing and word processing to downloading music, photo editing, movie

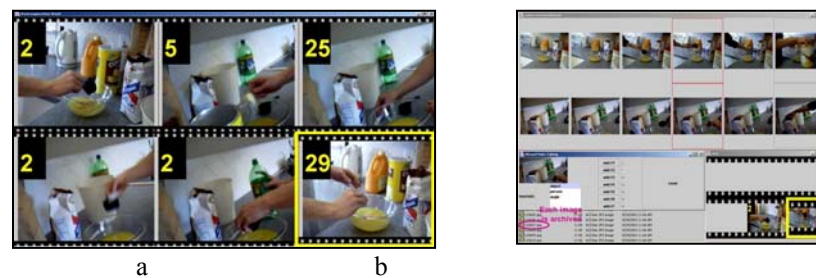
viewing and Web chat in the past few years. In the future everyday computing will be ubiquitous and can help households do much more and more things.

### 5.5.2 *Smart Home*

Smart home is an application of everyday computing. It is defined as a residence equipped with computing and information technology which anticipates and responds to the needs of the occupants, working to promote their comfort, convenience, security and entertainment through the management of technology within the home and connections to the world beyond (Frances K. 2004). There are various ways of conceptualizing the organization of elements which make up a smart home. Through this research, two have been found that consider the context-in-use design principle. Barlow and Gann (1998) focus on the technology. They distinguish three levels of technology: generic technologies which provide compatible building blocks for more elaborate systems; context-specific systems adapted to a variety of dwellings; and personalized systems tailored to individual and household requirements. The authors also consider the level of automation which the technology permits, distinguishing between fixed applications, programmable applications, and automated applications. Jedamzik (2001) focuses on both the control and the information which is available to the user, and proposes that a smart house has four components: user interface; technical field (controlling light, heat, climate, water); field of information (where the house serves as a knowledge base, e.g., health, household accounting, scheduling); and service field (connecting to external services, e.g., financial, legal, commercial, educational). Four leading research institutes are conducting academic projects of an experimental smart home. They are *The Adaptive House* (University of Colorado); *ComHOME* (The Interactive Institute, Sweden); and *The*

*Aware Home* (Georgia Institute of Technology). *The Aware Home* is a suburban house located on 10th Street in midtown Atlanta. It is equipped with high-speed internal and external connections, cameras and microphones, a house-wide wireless net allowing communication between cordless devices, and a radio-location system for tracking tagged objects. The following is an example of *The Aware Home* projects.

*Application: Aging in Place – Cook’s Collage, Memory Aid for cooking*



Picture Source: Everyday Computing Lab at Georgia Tech

The cook’s collage provides a visual summary (picture a) of recent cooking activity along a kitchen countertop. The current design emphasizes the temporal order of cooking events. Visual snapshots are arranged as a series of panels similar to a comic strip, ending with the most recent action highlighted in yellow. Repeated steps are annotated with their corresponding number count and preceded with slim vertical gray bars (i.e. visual eclipses). The picture shows a screenshot of the cook’s collage display as a cook prepares a punch recipe. Using a “wizard-of-oz” technique (picture b), a human operator simulates the intelligence for the cook’s collage system by hand picking images from the streaming live video feed as shown in figure 2. The wizard experiences are then transferred to later automate the tracking procedure.

## **CHAPTER 6**

### **EMOTIONAL DESIGN OF SMART PANTRY**

#### **6.1 PROPOSED EMOTIONAL DESIGN PROCESS**

Through this research an Emotional Design Process has been developed by applying both the appraisal theories and PFBS model in emotional design. The process includes five major steps (See Figure 6.1):

- A. Identify and measure the contextual appraisals of users' emotional reaction through user research;
- B. Update product knowledge through product research;
- C. Translate the research findings to product attributes;
- D. Design product human machine interface;
- E. Conduct user experience study.

An example is used to illustrate this process: Based on user's knowledge, a user has a need (e.g. listen to music) and intensity of the need (how much he or she likes it). A designer produces a design purpose for the product by product research and through user research, which is to gather and process user needs and the intensity of needs. The design purpose leads to a product function (which can meet the user's needs to some extent). A product structure is produced to facilitate the product function (e.g. the product is engineered to be able to play music in high quality). The user appraises the product by testing or using it. The generated emotional response feeds into the user's knowledge

base. This completes the cycle in emotional design process. The cycle can repeat for the enhancement of current design or for a new design.

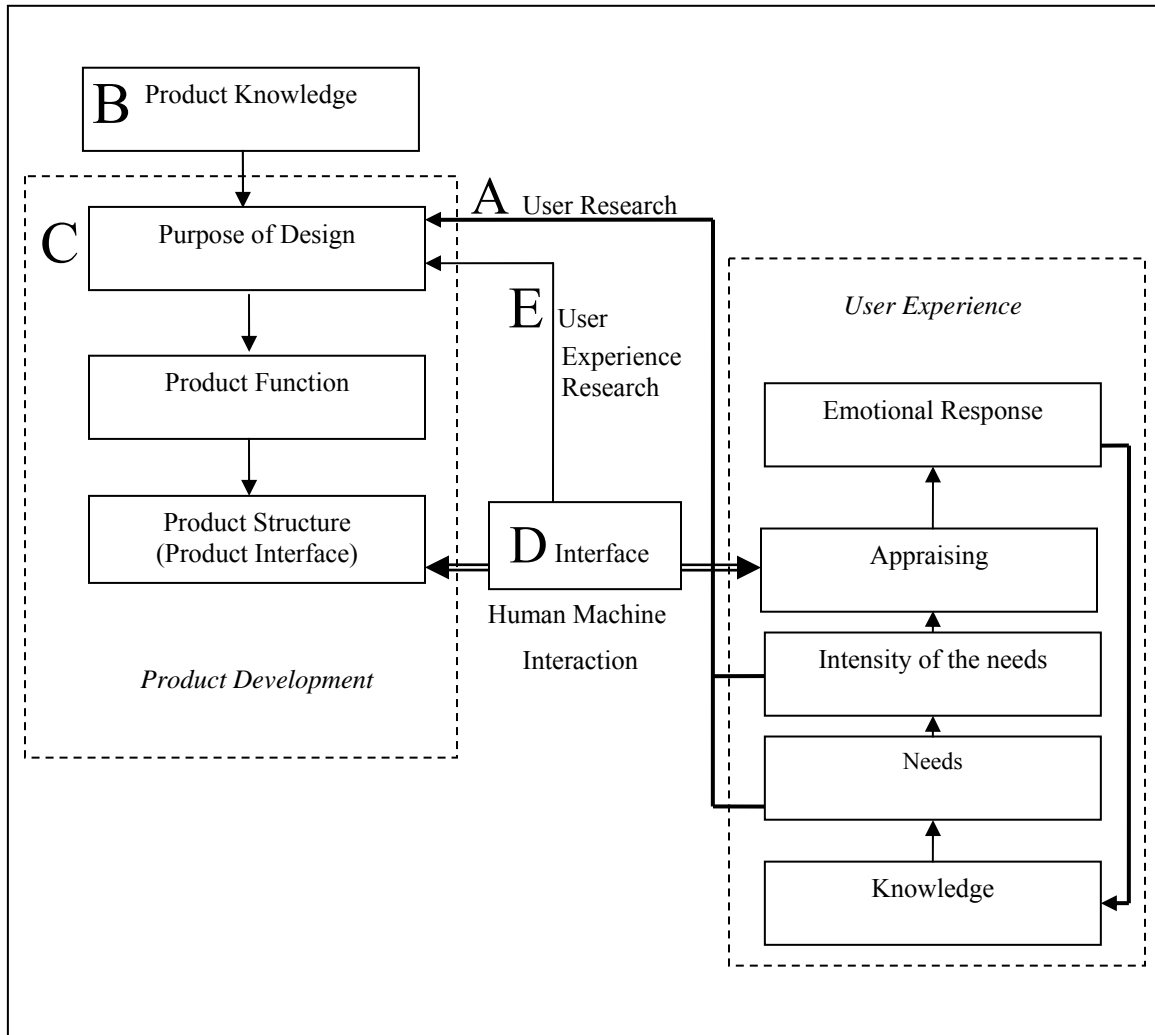


Figure 6.1 Emotional Design Process

## 6.2 SMART PANTRY DESIGN

The Emotional Design Process is applied to design a Smart Pantry for the target group (women between 45 and 60 years old).

### 6.2.1 Emotional Design Step A: User Research

User research methods, procedures and questions have been discussed in chapter 3 and research findings is presented in chapter 4. The emotional appraisal of the target research group is presented in figure 4.13.

### 6.2.2 *Emotional Design Step B: Product Study*

The findings of pantry storage product study and perspective of smart pantry are presented in chapter 5.

### 6.2.3 *Emotional Design Step C: Translate Users' Needs to Product Purpose Function and Structure*

Table 6.1 Product Purpose, Function and Structure of Smart Pantry for Target Group (women 45-60)

		Purpose	Function	Structure
<b>F i x e d  F e a t u r e</b>	Style	Regular shape warm tone color, neat & Clean	Look organized	Shelves; cabinets, draws; containers; screens; lights
	Material	Durable; flexible; efficient; cost effective;	Smooth surface; heavy duty; light weight;	Wood; steel wire; wicker; plastic
	Smell	Pantry smell clean	Avoid food smell exchange; Prevent chemicals evaporate;	Sealed draws, containers; air tight plastic bag;
	Taste	Food taste fresh	Temperature control; humidity control light control;	Temperature control system; humidity control system; non-chemical pest control system; no window
<b>I n t e r a c t</b>	Display	Offer logical cue; see through; hide stuff from view	Category things; invisible Storage	Transparent containers; closed cabinets and draws;
	Audio	Audio interaction	Reminder warning feedback	Speakers; audio System

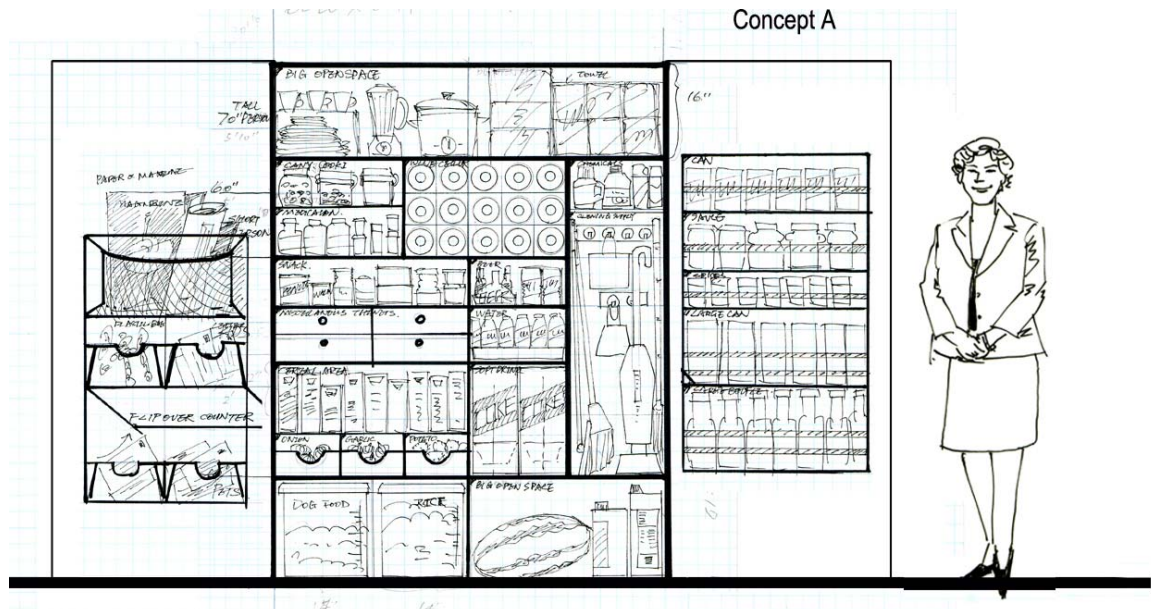


t i o n	Motion	Installation; access to the pantry; access to the stuff; remote access to grocery information; put stuff into the pantry; keep stuff in the pantry; carry stuff out of pantry	Easy installation; close or open pantry virtual pantry hold stuff tightly; category stuff; adjust height; take out and put back;	Pantry / Cabinet door computer software; computer 3D model; movable components; separate Components; remoter / cell phone controller;
	Navigate	Find items; check information;	Mapping; locating; tracking; searching;	Touch screen control; barcode scanner;
C o n t e x t	Time	Quick find items; save cooking time; deep food longer; changing inventory;	Inventory Information database; menu suggestion; separate different stuffs;	PC software; barcode scanner; separate Components;
	Environment	Keep food in good condition; find things easily; save space; adapt to different home;	Cool down the temperature; low down the humidity ; light design; storage efficiency; usage flexibility ; re-arrangement; Easy installation;	Electronic lights; stackable components;
	Social	Technology Trend; fashion Trend; marking efforts; energy Saving; prevent food waste; family Multi users; simplify life Style;	Inventory tracking; share recipes; online grocery purchase; customization;	Customized storage system; integrated PC; customized user interface; internet access; firewall protection;
	Personal	High life standard personal hobby healthy eating younger looking	Nutrition calculation menu suggestion; dietary consultant;	daily dietary reports

#### 6.2.4 Emotional Design Step D: Product Interface Deign

Smart Pantry has both human machine interface and human computer interface. Industrial designers are responsible for human machine interface development. A product's interface should visually imply its usage because pantry storage products are expected to be highly functional. However, product aesthetics are extremely important to emotional design because it can increase a products' desirability. The sketch shows a

pantry storage arrangement concept. It is a function-oriented design and addresses both the physical and emotional needs of users.



References on human factor in workstation and Interior design human body measurement can help designers decide dimension of the product. Additionally, American Disability Act (ADA) title II has detailed design standards for wheelchair users (<http://www.access-board.gov/adaag/html/adaag.htm>).

## 6.2.5 *Emotional Design Step E: User Experience Study*

### 6.2.5.1 Product Emotion Baseline

The user experience study is one of the most important steps in the whole emotional design process. A quantitative data analysis method called product emotion baseline is proposed to illustrate how designers can predict the users' emotional reaction by analyzing research data. In order to do that, designers need to collect three groups of

data. The first group of data is user expectation. Designers can not decide what features or functions need to be included in their design until they find out whether the users really want these functions and how much they want them. The second group of data is the user preference on existing product. Users judge their new product or product use experience based on previous knowledge. The last group is the data of user evaluation of test products.

In the online survey, participants were required to rate ten pantry storage product features based on previous experience and expectations. The evaluated ten product features are derived from polite study and interviews. Figure 6.2 shows the difference between the results of people evaluate their existing pantry storage products and what they expect from the products. Among those features, they rate the importance in order from high to low are: storage efficiency; easy installation & usage flexibility, invisible storage, organization, mapping & locating and style conformity. (See original data in Appendix A, online survey).

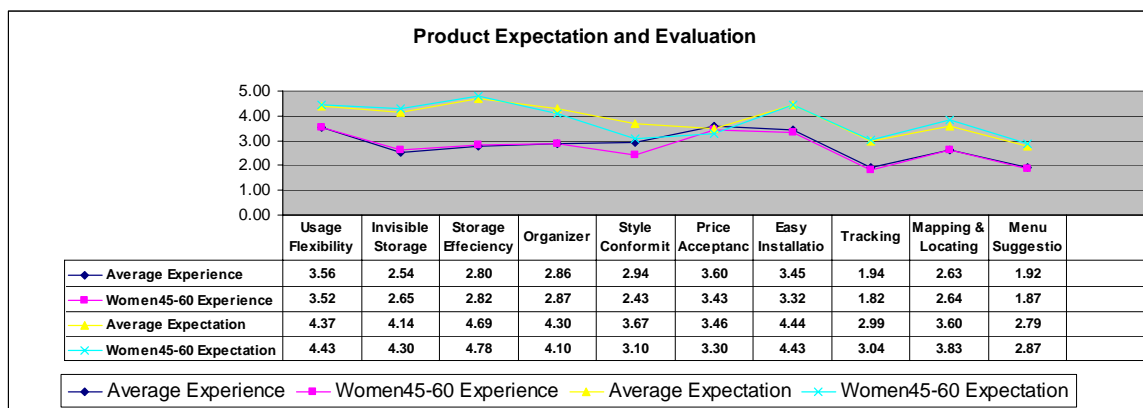


Figure 6.2 Product expectation and evaluation

Figure 6.3 shows the gap between expectation and experience among participants of the target group. The gap between expectation and experience of existing products in

order from large to small are: storage efficiency, invisible storage, organization, tracking, mapping & locating, easy installation, usage flexibility and style conformity. They thought their current products were moderately cost effective.

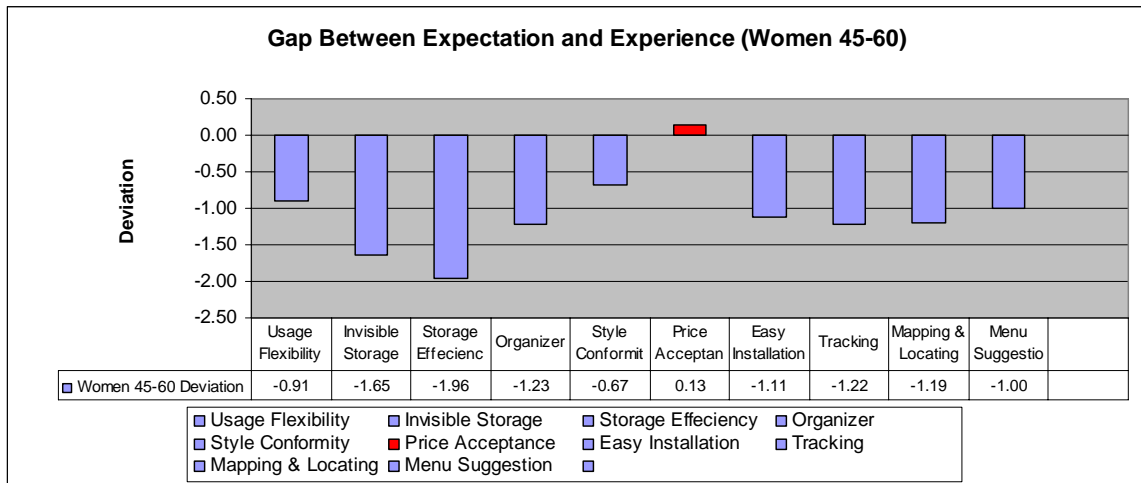


Figure 6.3 Gap between product expectation and experience in women (45-60)

Figure 6.4 shows the data analysis method - Product Emotion Baseline being applied to user evaluation on Smart Pantry. It shows the differences among the user expectation, user previous experience and rating of the product Y. Product Y is a hypothetic smart pantry product.

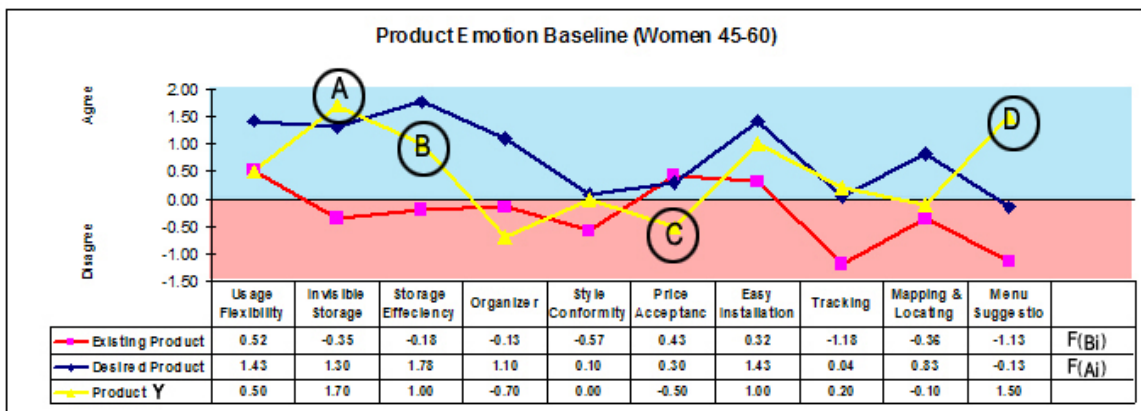


Figure 6.4 Product Emotion Baseline (women 45-60)

The blue line represents the desired product which is users' expectations on pantry products in general; red line represents existing pantry products; yellow line represents the tested mock product Y. X axis represents product features. Y axis represents user rating on these features. Positive numbers on the Y axis means an agreement and negative number means an disagreement.  $F(A_i)$  and  $F(B_i)$  refer to the math formula in chapter 3 section 3.5.4. Above the zero line is blue area and below is red area. A higher score attached to a product feature denotes a higher perceived. The following are the explanation of the four points (A, B, C, D) in figure:

A. Point A represents the score of mock product Y on feature storage efficiency.

The score is higher than both existing product and desired product which means users regard the mock product Y to exceed their expectations and existing products. Therefore, point A indicates to designers that they could expect positive emotional reactions from users on this product feature.

B. Point B is located below the desired product and above the existing product.

In this situation, users will approve the mock product Y, but they still hope for a better solution. If a point is located between the desired product and existing product, there are two possible scenarios: 1). The point is below the desired product but above the existing product (point B falls in this scenario); 2. The point is below the existing product but above the desired product. Under scenario 2, users are impressed by the existing product. So the product can evoke positive emotional reaction from the users only if it can exceed the achievement of existing product.

C. Because Point C is located below both desired product and existing product, the product would have to face a negative emotional reaction from the users.

D. Point D is similar to point A. The difference between point D and point A is that the users' need intensity of invisible storage (point A) is higher than it of menu suggestion (point D). Therefore, if design succeeds on invisible storage (Point A), it will evoke a stronger positive emotional reaction among users. And if it fails, it will evoke a stronger negative emotional reaction.

To further analyze the data obtained from Product Emotion Baseline, the data is processed through the Emotional Reactions Possibilities table (See Table 6.2). This table helps to identify users' emotional reaction in more subtle details. Based on the scores from desired product, users' need intensity is classified as low (L, score 2 – 3), medium (M, score 3 - 4) and high (H, score 4 - 5). Deviation (D) is the difference of scores on existing product and product. Emotional reactions are in four categories based on the deviation: positive certain, positive uncertain, negative certain and negative uncertain. The emotion labels such as happy, anxious, etc. changes as users' need intensity change. The more intense the needs are, the stronger emotions the users response.

Example 1: the users' expectation on storage efficiency is scored at 4.78, so the need intensity is classified in high. The deviation is 1.18 which means users think mock product Y is much more efficient on storage. Because the deviation is larger than 1, it indicates that users will have happy feelings to storage efficiency feature on product Y.

Example 2: Users' expectation on tracking is scored at 3.04. The need intensity is medium. The deviation is 1.38 which means users think product Y is much better on

tracking. Even though the deviation is greater than 1, due to the medium need intensity, it indicates that users will have satisfactory reactions to the inventory tracking feature on product Y.

The emotions label listed in the table are cited just as examples. Other emotion labels may be applied as well. In addition, different emotion labels may be found to be more appropriate depending on the context under the use scenarios.

Table 6.2 Emotional Reactions Possibilities of Mock Product Y

Emotion Process				Emotional Reaction			
Need & Need Intensity  Ai	Existing Product  Bi	Mock Product Y  Y	Deviation  $D=Y-Bi$	Positive		Negative	
				Certain $D>1$	Uncertain $1>D>0$	Certain $D<-1$	Uncertain $-1<D<0$
Storage Efficiency 4.78 (H)	2.82	4.00	1.18	Happy	Anticipatory	Frustrated	Anxious
Usage Flexibility 4.43 (H)	3.52	3.50	-0.02	Happy	Anticipatory	Frustrated	Anxious
Easy Installation 4.43 (H)	3.32	4.00	0.68	Happy	Anticipatory	Frustrated	Anxious
Invisible Storage 4.30 (H)	2.56	4.70	2.14	Happy	Anticipatory	Frustrated	Anxious
Organizer 4.10 (H)	2.78	2.30	-0.48	Happy	Anticipatory	Frustrated	Anxious
Mapping & Locating	2.64	2.90	0.26	Satisfied	Hopeful	Disappointed	Uneasy

3.83 (M)							
Price Affordance 3.30 (M)	3.43	2.50	-0.93	Satisfied	Hopeful	Disappointed	Uneasy
Style Conformity 3.10 (M)	2.43	3.00	0.56	Satisfied	Hopeful	Disappointed	Uneasy
Tracking 3.04 (M)	1.82	3.20	1.38	Satisfied	Hopeful	Disappointed	Uneasy
Menu Suggestion 2.87 (L)	1.87	4.50	2.63	Impressed	Curious	Preventive	In- difference

#### 6.2.6 Emotional Design Process for Smart Pantry



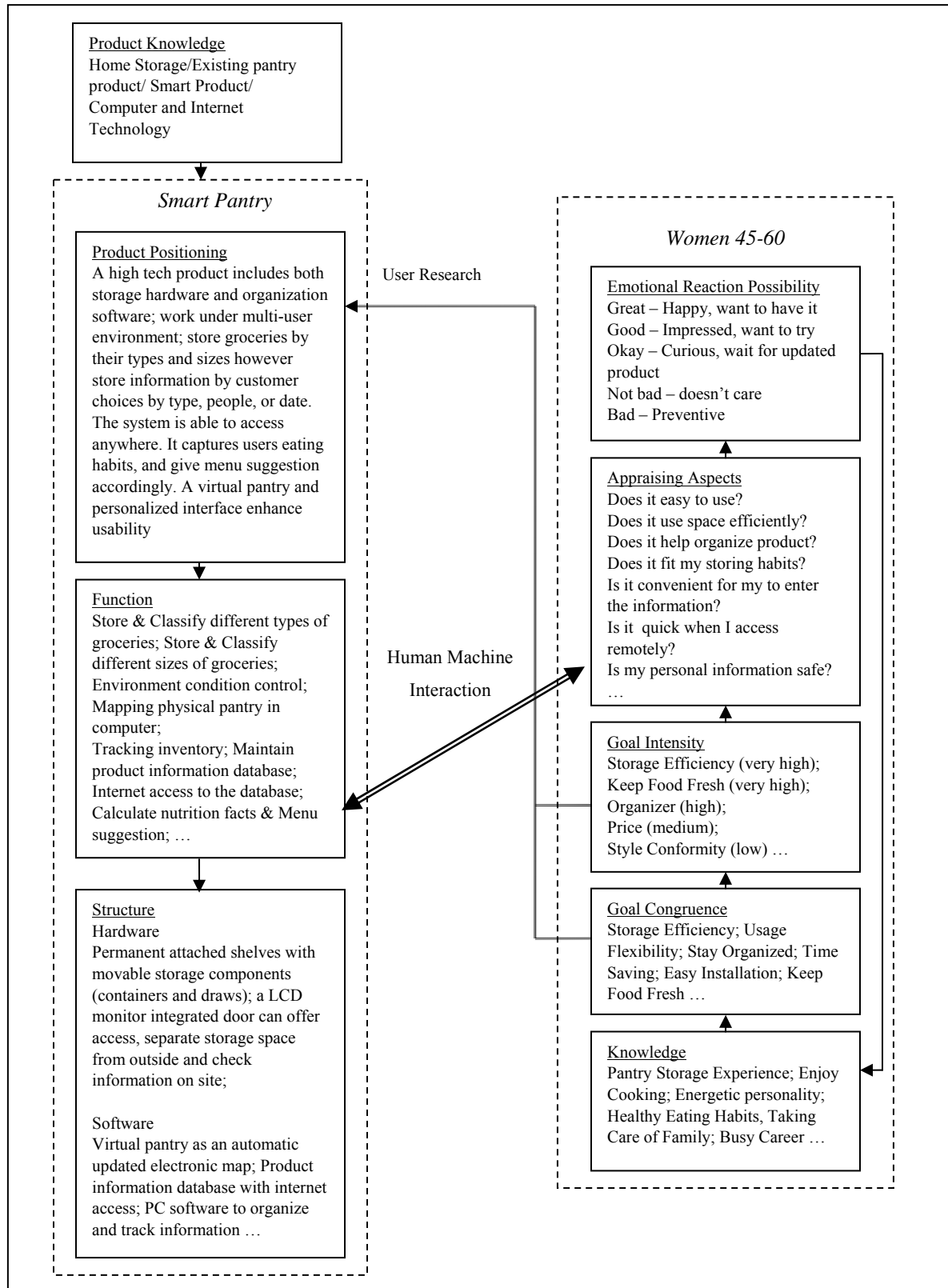


Figure 6.5 Emotional Design Process for Smart Pantry

### 6.3 PROPOSED SMART PANTRY

Compared to existing products, the proposed home groceries storage system – *Smart Pantry* – combines both hardware and software functions. The system has various storage components for different categories of groceries. These components are different in size, shape and material. The system also collects and stores grocery data for organizing, quick locating and inventory tracking. The smart pantry can categorize and map the family groceries needs, update shopping and meal plans, remind individual family members of dietary plans and daily nutrition needs.

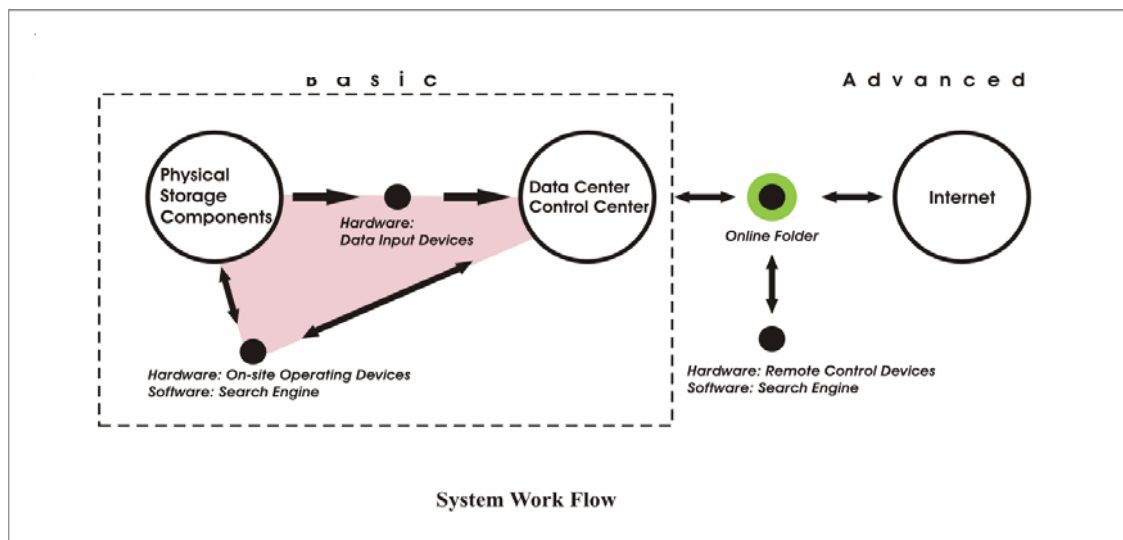


Figure 6.6 System Work Flow

The followings are the System Features:

#### 6.3.1 *Permanent attached skeleton with movable storage components*

Every people and every family have their own habits to arrange and organize items. A good storage product design has to leave enough flexibility to the users. Instead of obligating users to follow the designers' organization rules, the system offers many

possibilities of organizing items. Most importantly, the system assists users to find their most comfortable and suitable way of organizing their items.

### **6.3.2 A *virtual pantry***

With the smart storage product, users can easily and quickly find what they have and where they are. A multi-player map allows users to see their pantry on the computer. There are two ways of recording grocery information: 1) users input the related information into the computer; 2) users use a special scanner to scan the items and the system automatically updates items related information such as name, category, manufacturer, in-stock date, expiration date, quantity, function, nutrition facts and etc.

### **6.3.3 *Utilizing grocery data***

The system can keep track of inventory and make meal plan. For example, one has several boxes of pasta in the pantry, but he or she does not know what to eat. According to what he or she has at home, the system suggests five different pasta dish choices. By tracking a family's food consumption, smart storage products can calculate how much protein, cholesterol, vitamins, etc. for a day in gross.

### **6.3.4 *Access data locally or anywhere***

Data can be saved in a database in a home computer locally. Users can also get access to their data outside of their home if they choose to store these data on a secured web server. This provides the users with some extra benefits. For an instance, Mom decides to stop by a grocery store on her way home. She can access the inventory through her cell phone and the system gives her a suggested shopping list.

#### **6.3.5 *Multi-user environment with individual settings***

The average households have 2.59 persons (US census bureau, 2000). Since smart pantry is a family oriented product, it needs to be used by all family members. Smart pantry can organize data among multiple users. However, it also allows each family member to have his or her personal data space which is separated from the others.

#### **6.4 *Future Study***

Future study on emotional design of smart pantry can be conducted on the following two areas: 1). Gather more data on user expectation and user experience to verify the effectiveness of the product emotion baseline mode; 2). Expand product structures in the emotion baseline model to create a design guideline for smart pantry.

## APPENDIX A

### NOTES OF INTERVIEW AND ONLINE SURVEY

#### A.1 INTERVIEW

##### A.1.1 *Questions*

1. Are you age between 45 and 60?

P1:	Yes
P2:	Yes, I am
P3:	Yes
P4:	I am between 45 and 60
P5:	Yes
P6:	Yes
P7:	yes

2. Are you working now? (part time, full time, self business)

P1:	Part-time
P2:	Full-time
P3:	Full-time
P4:	Yes part-time
P5:	Full-time
P6:	Fulltime
P7:	Part-time

3. How do you describe your financial status?

P1:	Not wealth, Comfortable
P2:	Comfortable
P3:	Not wealthy but comfortable
P4:	Financially, comfortable, could be better
P5:	Comfortable
P6:	Comfortable
P7:	Comfortable, I want to earn more money but I don't want to spend money.

4. How do you describe your current life style?

P1:	Busy
P2:	Busy, Healthy, Happy, Disorganized
P3:	Busy, a little stressful sometimes, enjoy life
P4:	I am mordantly busy, my stress come from my teenager son.
P5:	Busy, healthy
P6:	Busy, healthy
P7:	Busy, some times a little stressful with my husband

5. What's your main hobby or entertainment after work?

P1:	Reading
P2:	Weight loss
P3:	Reading (fun things); Watching TV: comedy
P4:	Computer, reading, rubber stamp, watch TV, taking care of dog
P5:	Watching TV, cleaning house, teach kids to do homework
P6:	Reading & Yard work
P7:	Watching TV: TV series & news

6. Do you like shopping? How much do you like shopping?

P1:	Yes, I like shopping; average
P2:	Yes, very much; shopping every weekend
P3:	Sometimes frustrating. For an instance, when I can't find what I am looking for. I'm an objective shopper.
P4:	No, I don't like to shop in mall. It's too noisy. I am not interested in clothing. I don't like to drive far from home. But I love grocery store shopping.
P5:	Yes, I like window shopping. Specially like kitchen supply. I used to spend lots of time shop for clothing. But I didn't do it any more.
P6:	No, because it takes time
P7:	No, not right now. I like to shop when I was young.

7. Do you like cooking? How much do you like cooking?

P1:	Yes; average
P2:	Good at desert
P3:	I enjoy cooking when I have time
P4:	Yes, I do. I prepare dinner for family. Invite family for dinner
P5:	Yes, I like to cook. But I don't cook often. I like to learn new dishes.
P6:	Yes, I like to cook every day
P7:	I cook a lot, but it doesn't mean I like to cook. I have to cook for the big family.

8. Do you use recipes or cooking books to cook?

P1:	Both
P2:	Yes both, I prefer cooking book
P3:	Yes, I use both of them. I like to try new thing, I use recipes but I am not strictly follow the recipients. Allrecipes.com (people review the recipes and rate the recipes and share their experiences)
P4:	Both. I collect them from my friends for a while. Occasionally, go online to find recipes
P5:	Occasionally, I ask my fiends about the recipes.
P6:	Yes, half time I use recipes
P7:	Yes, I didn't know how to cook before. I leaned a lot from the book.

9. How often do you shop for groceries?

P1:	Weekly
P2:	Every other week
P3:	Minim once a week (weekend)
P4:	Twice a week
P5:	Twice or three times a week
P6:	Weekly. I like fresh vegetables and foods, I don't want to keep too much stuff at home. I just buy weekly supply.
P7:	Once a week

10. Are you the person in charging of shopping and storing groceries at your home?

P1:	Yes
P2:	Yes, I am
P3:	Yes
P4:	My husband and I share the responsibility
P5:	I share my responsibilities with my husband. Most of my job are shopping clothing for them and taking care of the kids. My husband does most of the cooking.
P6:	yes
P7:	Yes, I also response for my son's family groceries shopping.

11. How long is it since you have been living in this house?

P1:	28 years
P2:	5 years
P3:	10 years
P4:	6 years
P5:	4 years
P6:	8 month leasing
P7:	7 years

12. Do you live with anyone else at your house? Who are they?

P1:	Husband
P2:	Yes, my spouse
P3:	Husband, mother in law and teenager daughter
P4:	Husband, teenager son
P5:	My husband, one boy 7 and another 17
P6:	Adult child, 18 years old
P7:	My husband, at the same time I take care of my two grand kids.

13. Do you feel that you have enough storage space in your pantry?

P1:	Yes
P2:	No
P3:	Yes
P4:	No, I have to move things from pantry down to the basement.
P5:	No, I put them everywhere
P6:	yes
P7:	I don't have enough space. I buy a lot when it is on sale.

14. What's your favorite color for your kitchen?

P1:	Blue
P2:	Green
P3:	Sage Green
P4:	white
P5:	yellow
P6:	Green
P7:	Cream.

15. What's your favorite style for your kitchen?

P1:	Warm tone, wood
P2:	Warm tone, wood
P3:	Transitional, well-made wood furniture
P4:	I have traditional style. I like Tuscanny, Italian kitchen. I sow it on cooking show.
P5:	Open Kitchen. Big island with stove in the middle
P6:	Rich Cherry Cabinets/ Warm tone
P7:	Open kitchen, so when I am working, I still can see TV and talking to others.

16. Do you have a computer at home?

P1:	no
P2:	yes
P3:	Yes.
P4:	yes
P5:	Yes. (mac)
P6:	Yes
P7:	Yes

17. What do you use your computer for?

P1:	NA
P2:	Shopping on ebay; pay bills; search information
P3:	Internet; I share computer with other family members
P4:	Everyday I use it to do my banking, listen music.
P5:	I like apple operation system better
P6:	I use it for internet
P7:	I don't use computer

18. Do you have a cell phone?

P1:	Yes
P2:	Yes
P3:	Yes
P4:	yes



P5:	Yes, we have family plan
P6:	Yes
P7:	No

19. Do you use internet?

P1:	No
P2:	Yes
P3:	yes
P4:	yes
P5:	Yes
P6:	Yes, everyday
P7:	No

20. What do you do online?

P1:	NA
P2:	Shop, E-mail, check news
P3:	Look up for recipes; Pay bill; Make vacation reservations; Not very often check emails
P4:	I look at Harry Bolter website for entertainment; Online banking; I have an ebay account
P5:	News, email, I don't chat; I do shopping for flight tickets and telephone card. I don't use online banking, because I don't trust it.
P6:	Check bank account I read <i>AJC &amp; Seattle Time</i> everyday
P7:	NA

21. Where do you store and organize your groceries?

P1:	Pantry
P2:	Storage pantry, big fridge
P3:	Pantry, laundry room, island, one cabinet
P4:	pantry, basement, under the sink in the bathroom, also in the laundry room
P5:	Pantry, closet, cabinet
P6:	In my pantry
P7:	Pantry, cabinet, refrigerator, garage (dry food and soft drinks)

22. How often do you check the inventory of your pantry?

P1:	monthly
P2:	Every weekend before shopping
P3:	Once a week before shopping. I have a good idea about what I have
P4:	Every week
P5:	I don't check them because I remember those information by mind and every time when I go to the pantry, I know what I have and what is used up.
P6:	Weekly before shopping
P7:	Twice a year.

23. What kind of storage products are you using currently in your pantry?

P1:	Plastic container
P2:	Shelves, glass container, plastic container
P3:	Wire shelves, wreck baskets
P4:	Plastic container, baskets, Ziploc bags, paper bags. Something are labeled
P5:	Package boxes, shelves, cooking ware, plastic container
P6:	No, I have enough space in the pantry. I just put the food boxes in
P7:	Shelves and containers, paper boxes

24. What do you use them for?

P1:	Staples like flour, meal, sugar, pasta, tea, coffee
P2:	Store flour, tea bags, sugar ...
P3:	Wreck basket to classify items
P4:	I use them to store and classify things
P5:	I just put my stuff on shelves when I was back from groceries shopping
P6:	NA
P7:	I have to classify them, I put small items in a plastic basket

25. How often do you or the other family members use them?

P1:	Daily (2)
P2:	Everyday-10 to 12 times or more (2)
P3:	10 per day (4)
P4:	5-6 per day (3)
P5:	7-8 per day (4)
P6:	3 times a day (2)
P7:	5-6 per day (2)

26. What are the good features of the products that you like?

P1:	Air-tight containers
P2:	Washable, Stackable, lids, see through
P3:	
P4:	Air tight keep food fresh, easy to open, fit well
P5:	I like the rolling plate. It's easy access and very convenient. I use it for all the cooking ware display.
P6:	The stuff I can stack up, Can & boxes are good
P7:	They help me to classify items

27. What are the bad features of the products that you dislike?

P1:	
P2:	Take up too much space on the shelves
P3:	Not easy to see everything. The shelves are not adjustable
P4:	Wire shelves are bad, because they will fall
P5:	I don't like the selves. The space between two shelves are all equal and that is not good for different sizes product.
P6:	The thing can't stack
P7:	I can't see what's inside.

28. Do you think your pantry storage products are functional? (if no, why)

P1:	Yes
P2:	Yes
P3:	No, I want to be more organized.
P4:	Most of them are functional
P5:	It's okay. It's about 80% efficiency of space usage.
P6:	Yes
P7:	okay

29. Do you think your pantry storage products are visually attractive to you? (if no, why)

P1:	Yes
P2:	Yes, I select the color
P3:	No, its all open
P4:	No
P5:	I don't care about that.
P6:	Okay
P7:	No, it's too small. I have to separate groceries to different places

30. What is the most important to you, the function, the look, the price, or anything else? (can you explain why?)

P1:	Function
P2:	The function that helps on the price
P3:	Function
P4:	function
P5:	function
P6:	Function
P7:	Function

31. Do you have any special needs of your storage products?

P1:	No
P2:	Yes, I am a short person
P3:	Clean pantry
P4:	Better organized; My problem is time, each family member has different schedule and my son is a picky eater. I don't prepare enough meal.
P5:	Open shelves and closed draws, Big divided space at the bottom for big heavy items
P6:	Not really
P7:	Bigger pantry, More containers, Not just shelves

32. Do you have any problem to reach height?

P1:	No
P2:	Yes, I am a short person
P3:	Yes
P4:	No
P5:	No, I don't
P6:	No
P7:	Yes, I am short

33. Do you have any problem to bend you body?

P1:	No
P2:	No
P3:	No
P4:	No
P5:	No
P6:	No
P7:	No

34. Do you have any problem to see the labels?

P1:	No
P2:	No
P3:	No
P4:	Yes, I put things in front of the others. I can't read dark color label or small font label on the packages.
P5:	No
P6:	No
P7:	Yes, I can't see thing closely and my left have serious near sight

35. Do you have any problem to remember where you have put your groceries in your pantry?

P1:	No
P2:	No, most of the stuff is organized to see through
P3:	No
P4:	All the time, I separate our grocery. We thought about have a list or computer program to organize them. Cause one of my friend does.
P5:	No
P6:	No
P7:	If I don't use them for a while, I will forget. But I feel that I have a good memory.

36. Do you have any problem to organize your pantry? (For example, you put other than food in your pantry. Why?)

P1:	No
P2:	Space, I need a bigger pantry
P3:	No
P4:	Yes, I like to keep all the cereals on one shelf.
P5:	No
P6:	I could do better on organization.
P7:	Not enough room. Although I remember where I put them, I can't find it

37. Have you done any changes on any of your storage products to fit your specific needs?

P1:	No
P2:	No
P3:	No
P4:	No
P5:	No
P6:	No. I have enough space
P7:	No

38. Do you use any computer software to help you organize your pantry?

P1:	No
P2:	No
P3:	No
P4:	No
P5:	No
P6:	No
P7:	No


39. How do you like the idea to use computer control your pantry? If not, why?

P1:	To bothersome
P2:	No, I don't want to go to the computer to check pantry.
P3:	Yes
P4:	Yes, I'd love to. That will be great to have a menu for week, it help shopping. It will be good for my mother in law. Once because of hurricane, they lost the power. So they lost everything in the fridge. If they have anything to proof what they have in the fridge, the insurance company will pay for that.
P5:	I don't feel I have needs for that
P6:	For my sister that is great. She lives in North Carolina. She has one year food supply storage. Mormon churches believe being well prepared. My mom lives in mountain, so she keeps three months' supply.
P7:	The idea sounds good. But I don't know how to use computer. Do I need to input information every time when I put stuff into the pantry?

40. If yes, how do you like to control it? (home PC monitor, remote, integrated screen on product or anything else?)

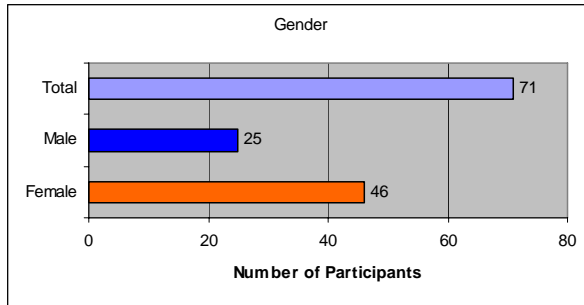
P1:	NA
P2:	NA
P3:	PC
P4:	Portable remoter
P5:	Integrated screen
P6:	PC program
P7:	TV monitor and remote.

### A.1.2 Photo Lists

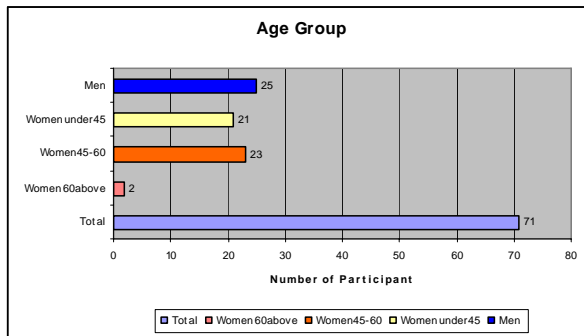
	P1	P2	P3	P4	P5	P6	P7
Pantry							
							
							
Kitchen	no						
	no						
Family room	no				no		
Dinning area							
							
Home office		no		no			no
PC	no						
Cell phone							no
Shopping list	no	no		no	no	no	
Favorite place	no	no				no	
	no	no				no	
Things they like							
							
Things they dislike	no	no			no		
	no	no			no		

## A.2 ONLINE SURVEY

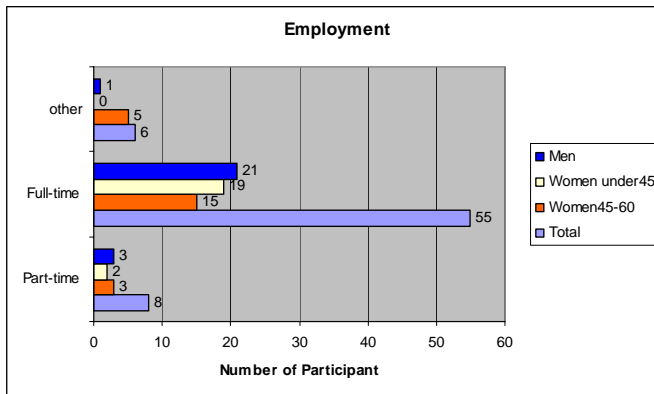
What's your Gender?



How old are you?

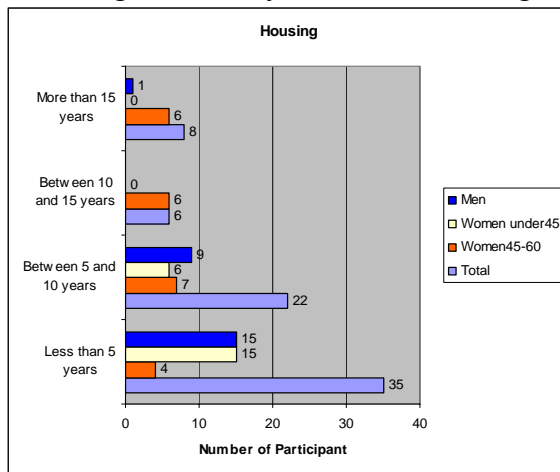


Are you working currently?

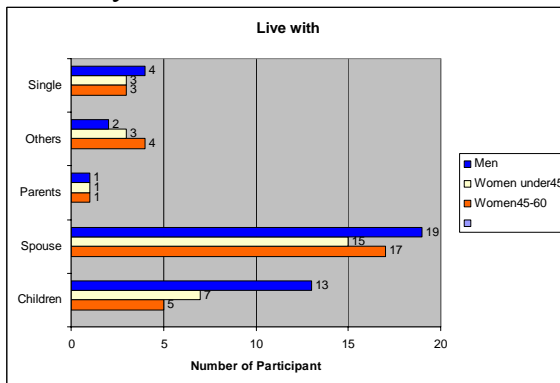




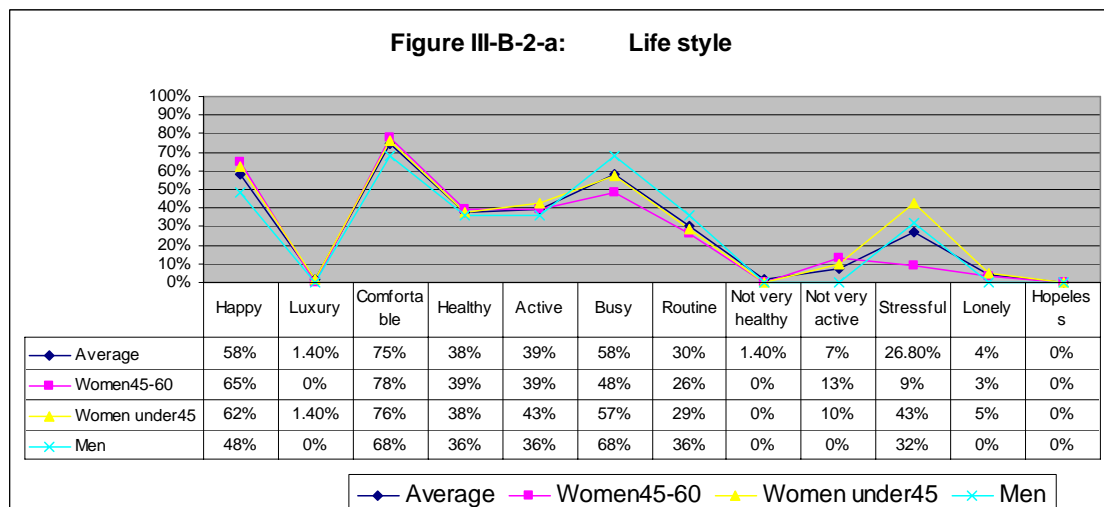
How long is it since you have been living in your current house?



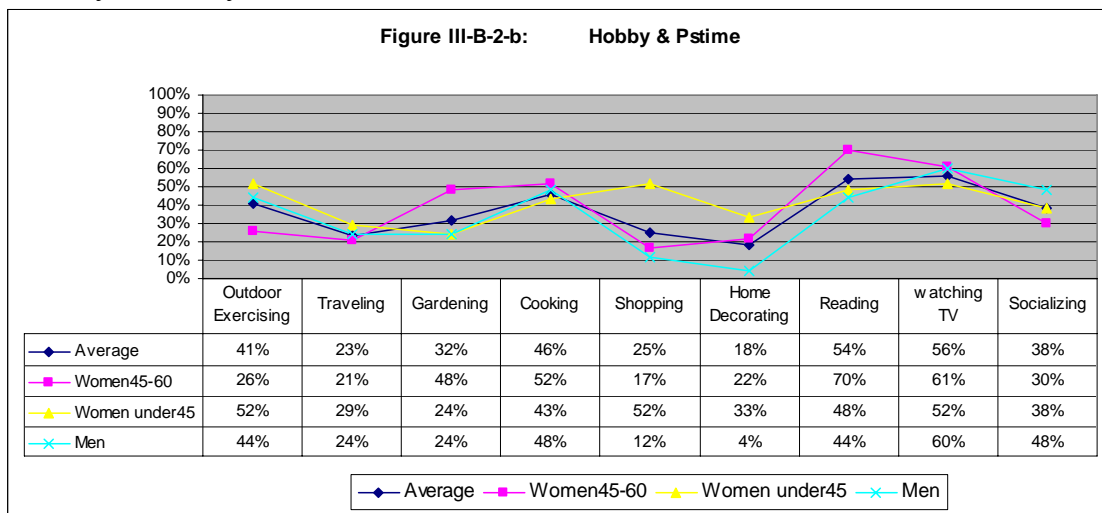
Who do you live with?



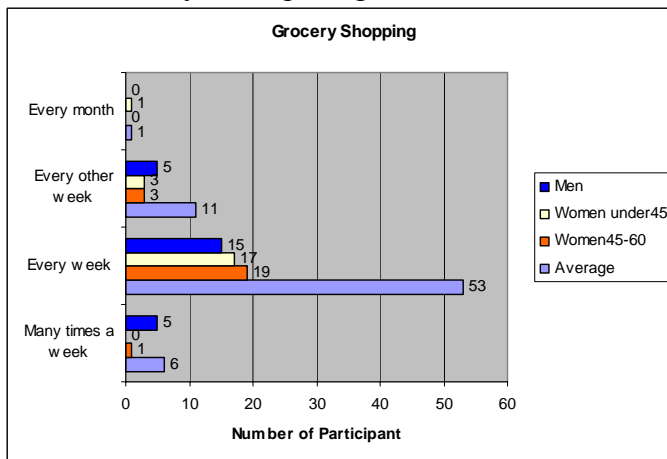
How do you describe your current life style?



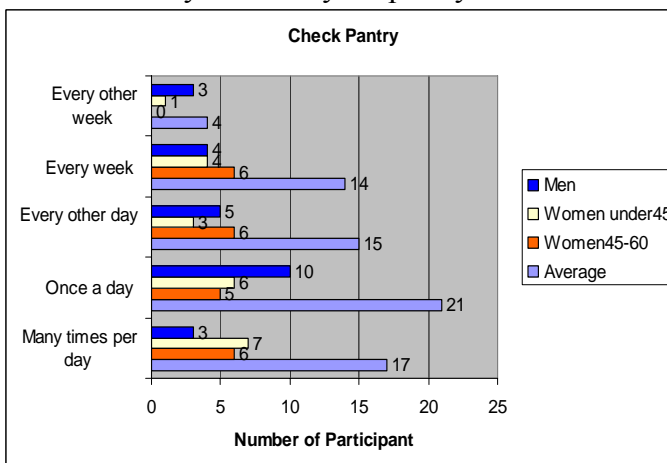
## What's your hobby or entertainment after work?



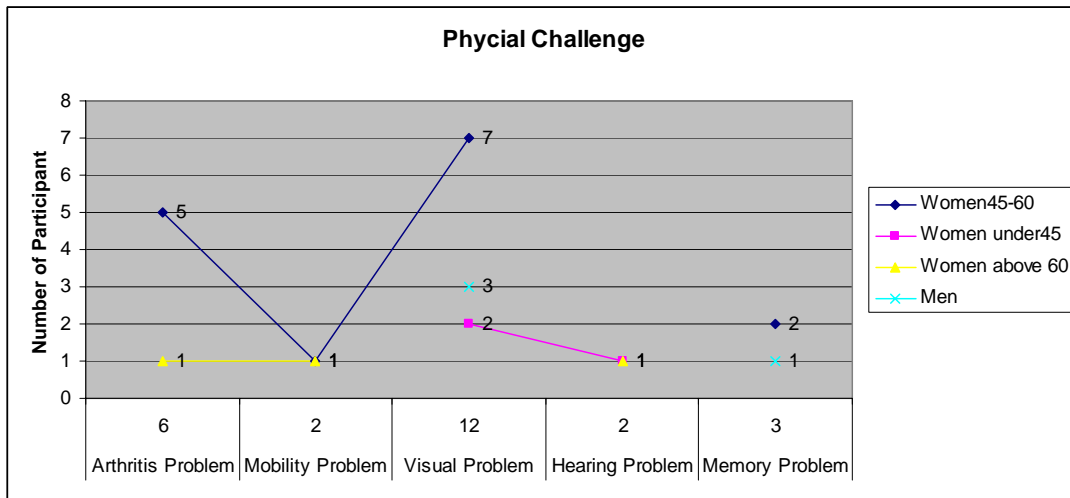
## How often do you shop for groceries?



## How often do you check your pantry?

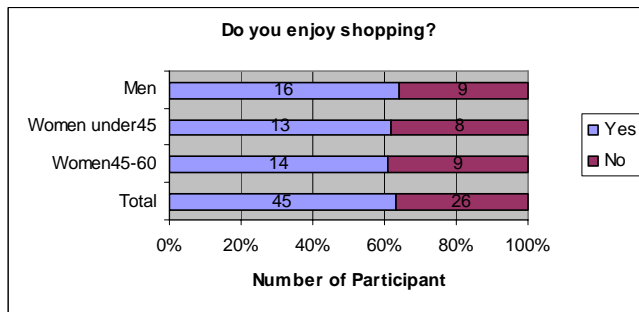


Do you have any physical problem?

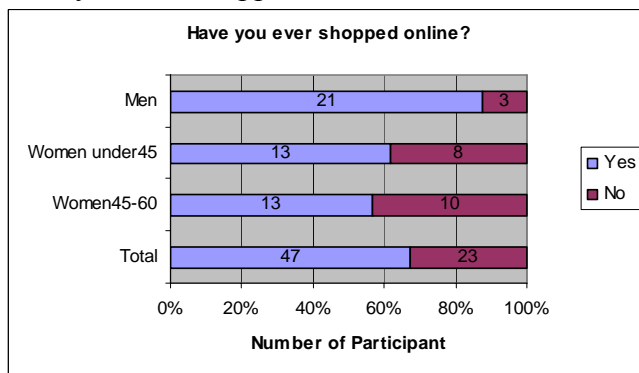


### A.2.2 Yes or No Questions

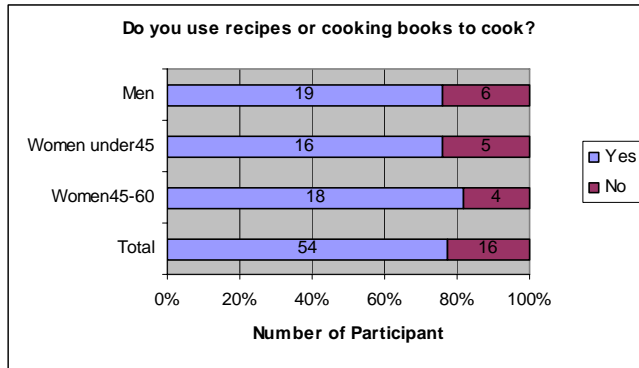
Do you enjoy grocery shopping?



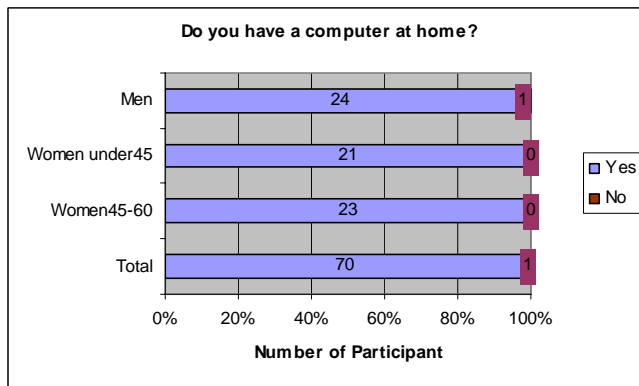
Have you ever shopped online?



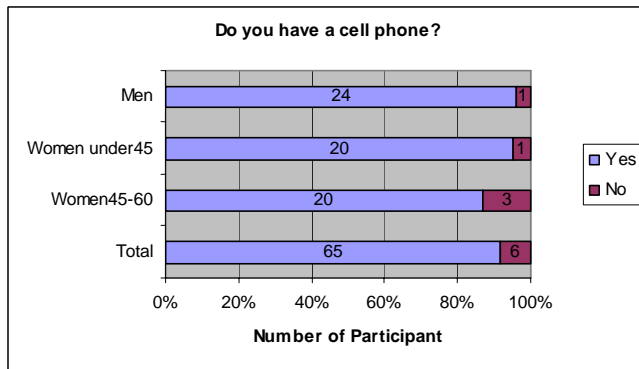
Do you use recipes or cooking books to cook?



Do you have a computer at home?



Do you have a cell phone?



Which MP3 player do you like better, BW or Color?

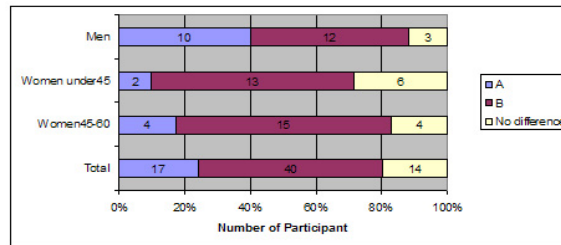
Product Feature Comparison: Color vs. No color



a



b



Which mobile phone do you like better?

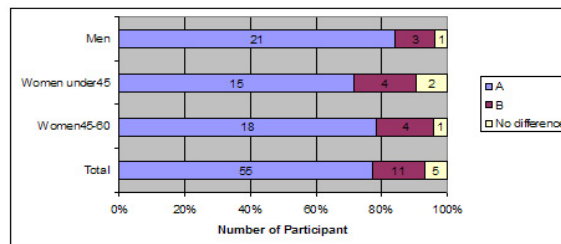
Product Feature Comparison: Regular vs. Irregular



a



b



Which control method do you like better ?

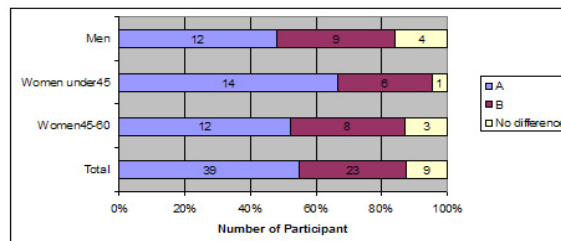
Product Feature Comparison: Innovative vs. Traditional



a



b



Which refrigerator do you like better ?

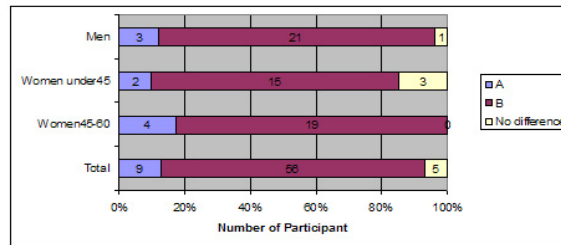
Product Feature Comparison: Low-tech vs. High-tech



a



b



Which kitchen refrigerator surface material do you like better?

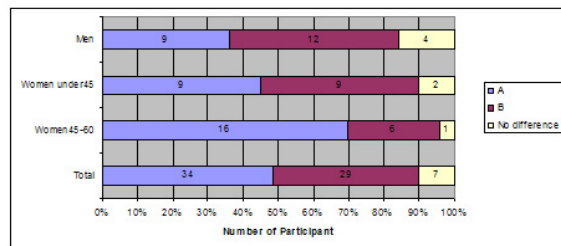
Product Feature Comparison: Wood vs. Steel



a

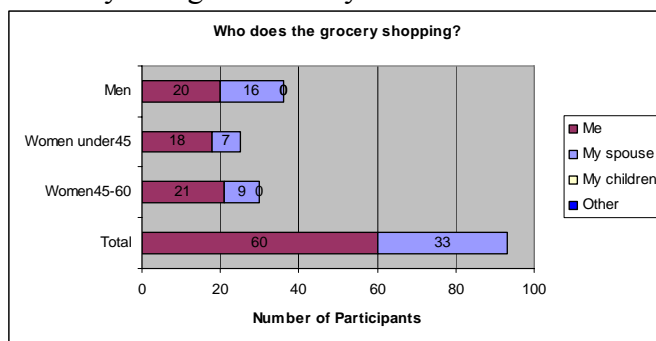


b

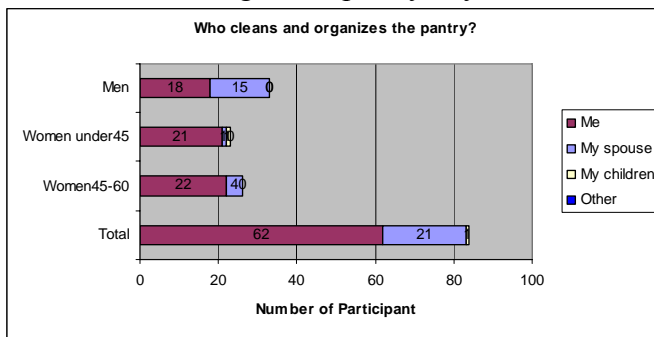


### A.2.3 Multiple Choice Questions

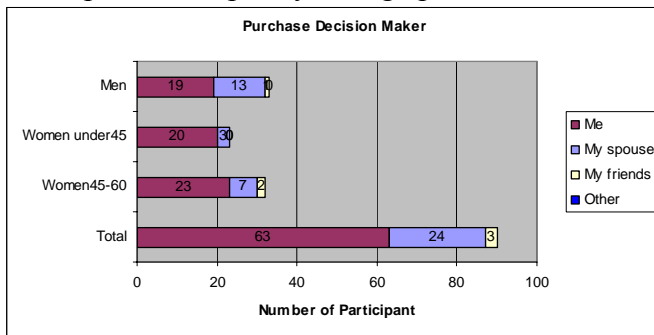
Who buys the groceries at your home?



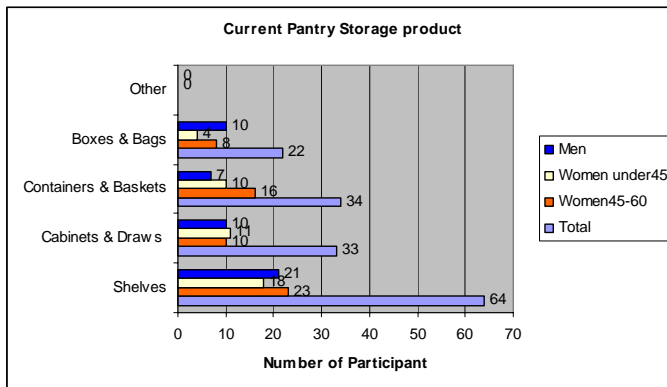
Who cleans and organizes pantry at your home?



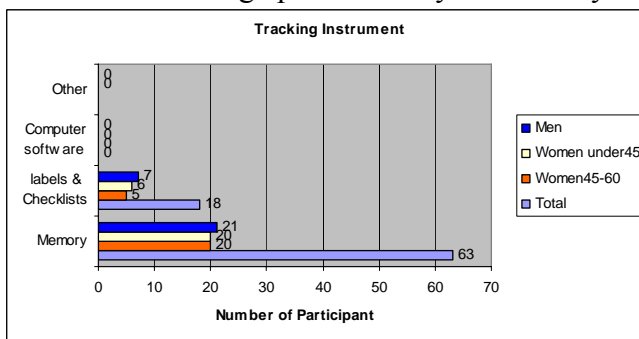
When purchase a pantry storage product, who is the decision maker?



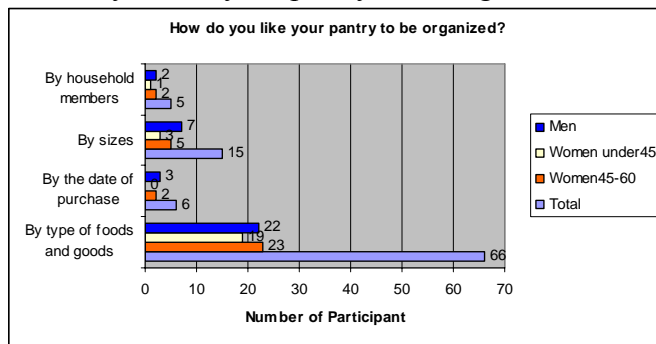
What kind of storage products do you use currently in your pantry?



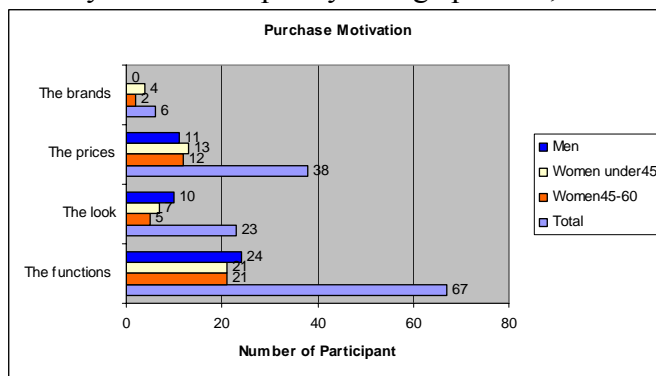
What kind of storage products do you currently use to track your stuff in pantry?



## How do you like your pantry to be organized?

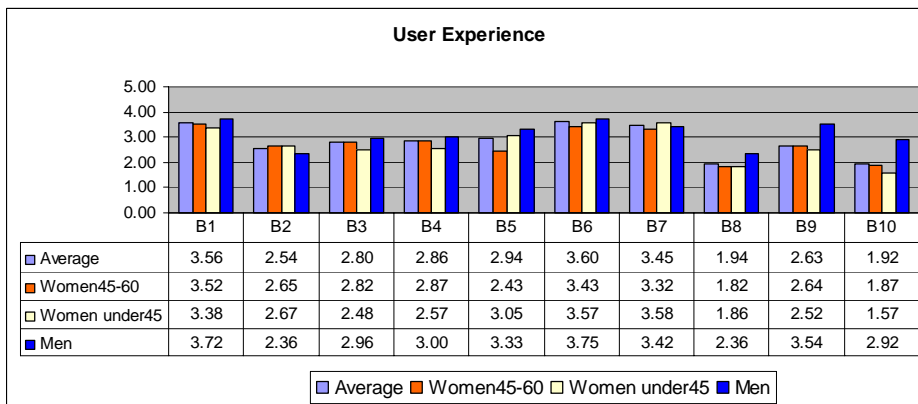
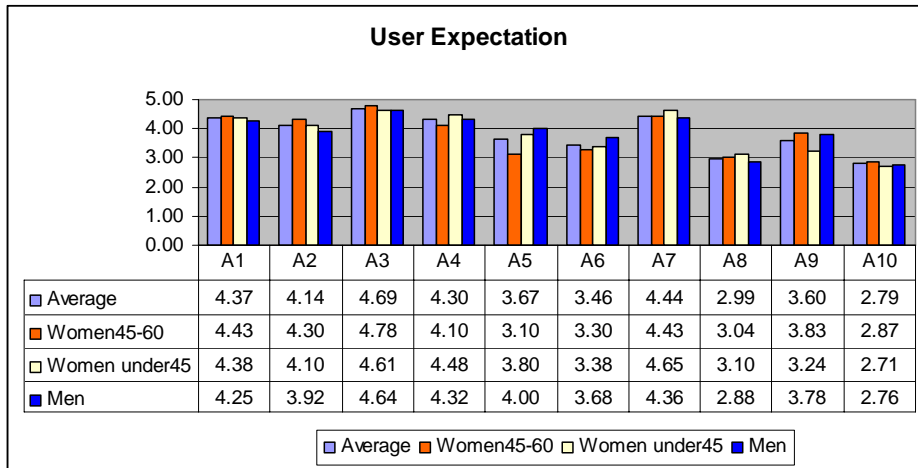


## When you choose a pantry storage product, what is the most important to you?

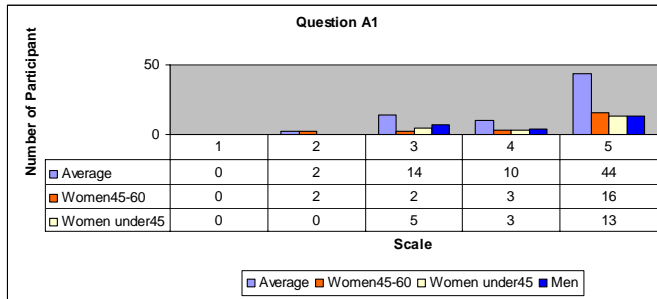




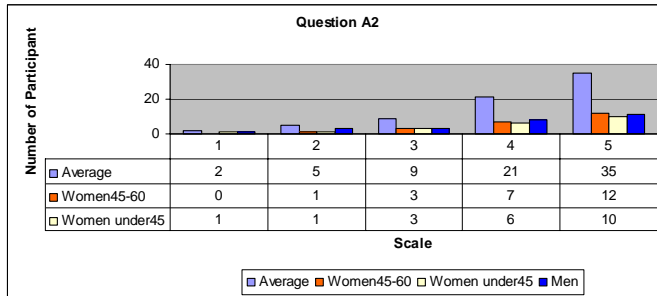
**A.2.4 Scale Questions (Pick the score among 0 to 5, 0 means strongly disagree; 5 means strongly agree)**



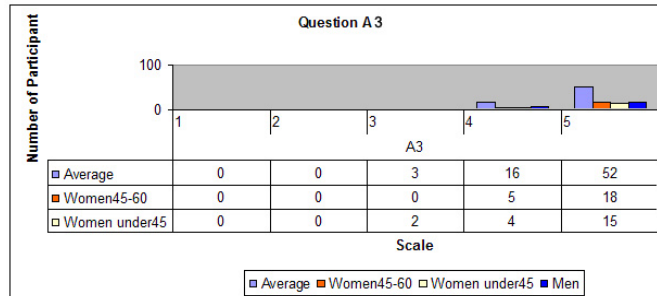
A1. Do you think that pantry storage shelves should be adjustable?



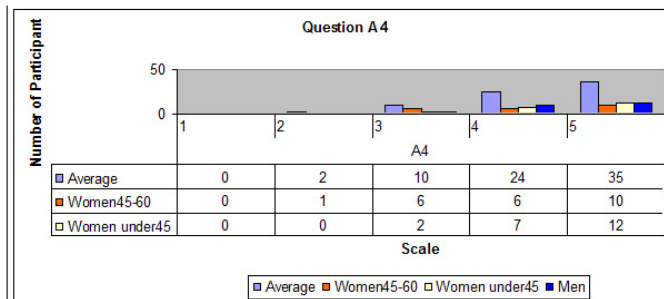
A2. Do you think that pantry storage products should be able to be closed?



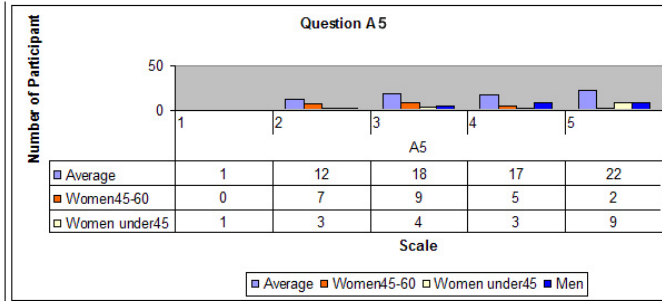
A3. Do you think that pantry storage components should save space?



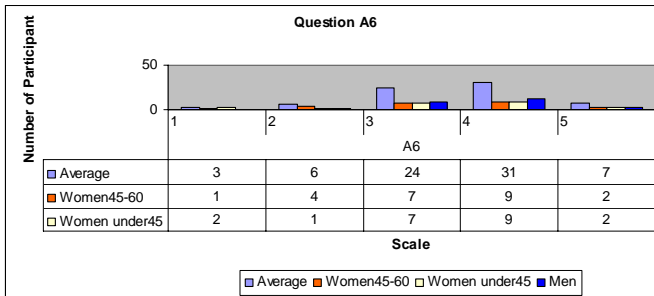
A4. Do you think that a good pantry storage product should offer an organization solution?



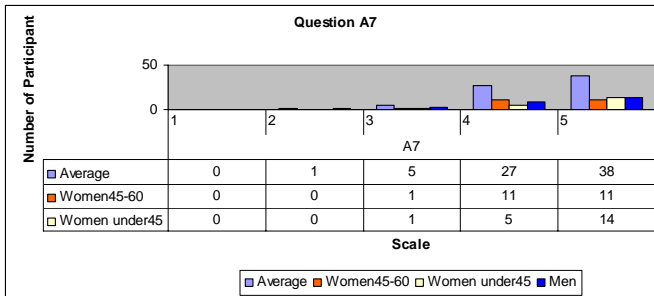
A5. Do you think that your pantry should look consistent with your kitchen?



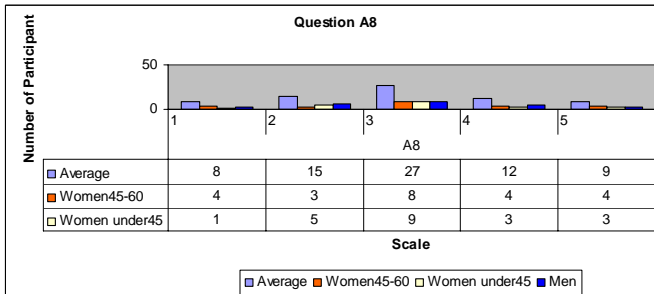
A6. Do you think that you will be willing to pay extra for better pantry storage products?



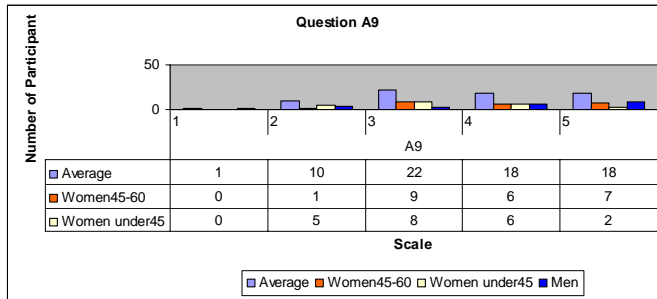
A7. Do you think that the pantry storage products should be easy-installed?



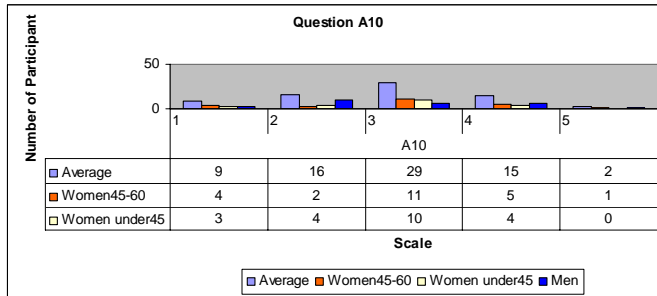
A8. Do you think that the pantry should have inventory-tracking function?



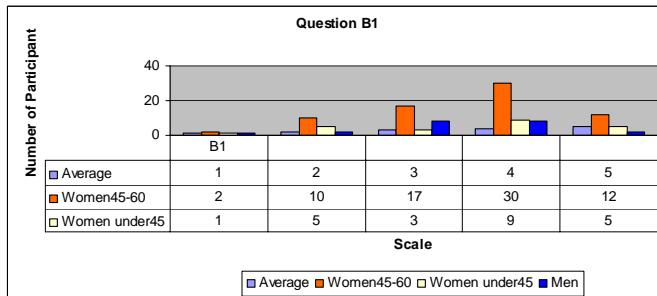
A9. Do you think that the pantry should be able to help you locate items?



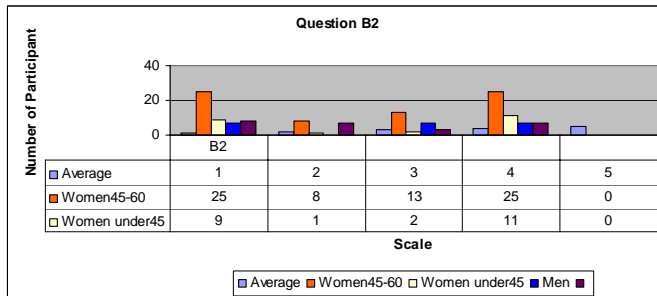
A10. Do you think that the pantry should be able to make healthy menu suggestions?



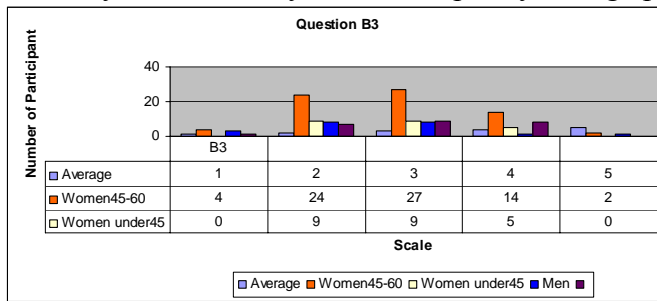
B1. Do you think that your stuff can fit in current pantry shelves?



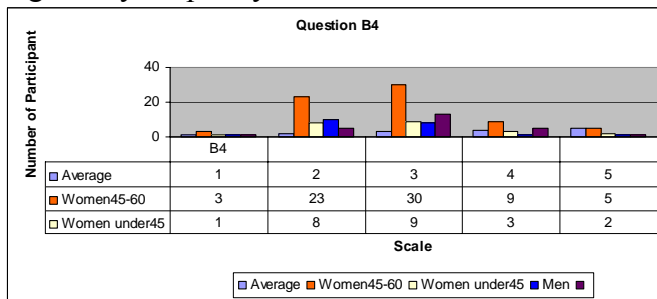
B2. Do you think that your current pantry can hide your stuff out of your sight?



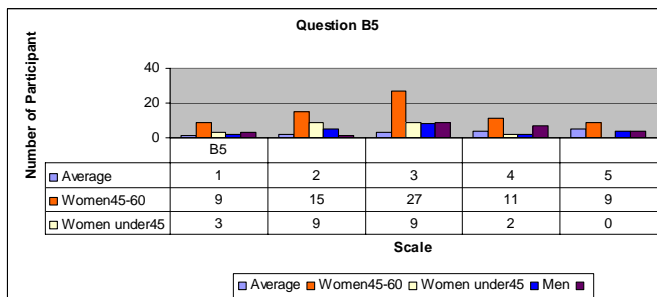
B3. Do you think that your current pantry storage products use space wisely?



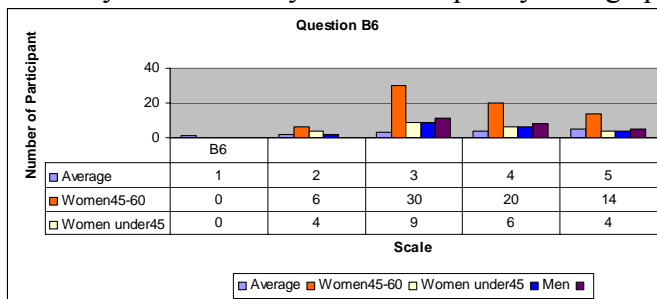
B4. Do you think that your current pantry storage products offer you a good way to organize your pantry?



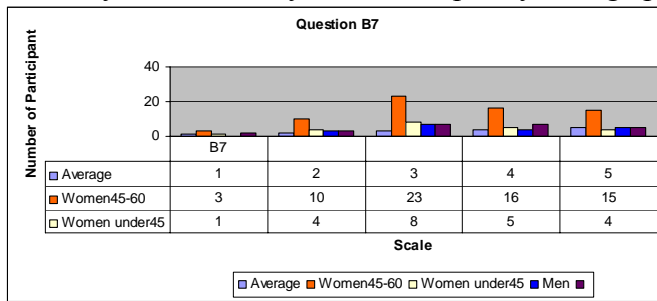
B5. Do you think that your current pantry storage products look consistent with your kitchen?



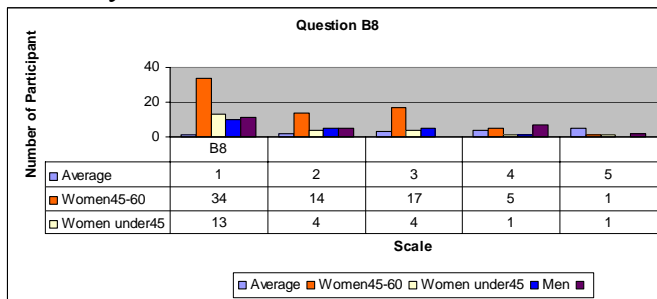
B6. Do you think that your current pantry storage products are very cost effective?



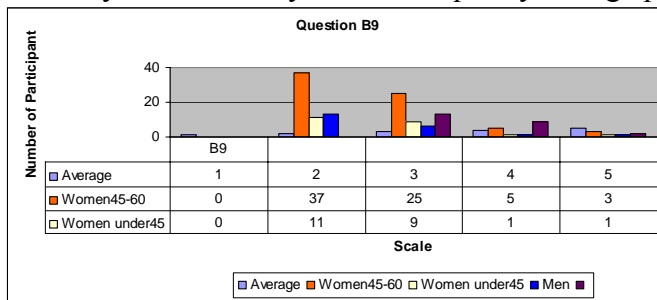
B7. Do you think that your current pantry storage products are easy to install?



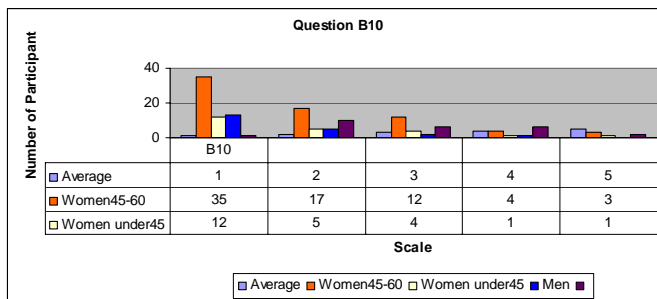
B8. Do you think that your current pantry storage products can help you track your pantry inventory?



B9. Do you think that your current pantry storage products can help you find things?



B10. Do you think that your current pantry storage products can help you eat healthier?



## **APPENDIX B**

### **DESCRIPTION OF DEFAULT SUBHEADING SCHEME**

#### **B.1 EXPLANATION**

##### **B.1.1 *James-Lange Theory***

According to this theory, actions precede emotions and the brain interprets said actions as emotions. A situation occurs and the brain interprets the situation, causing a characteristic physiological response. This may include any or all of the following: perspiration, heart rate elevation, facial and gesture expression. These reflexive responses occur before the person is aware that he is experiencing an emotion; only when the brain cognitively assesses the physiology is it labeled as an "emotion".

##### **B.1.2 *Cannon-Bard Theory***

Cannon and Bard opposed the James-Lange theory by stating that the emotion is felt first, and then actions follow from cognitive appraisal. In their view, the thalamus and amygdala play a central role; interpreting an emotion-provoking situation and simultaneously sending signals to the ANS (autonomic nervous system) and to the cerebral cortex which interprets the situation cognitively.

##### **B.1.3 *Schachter-Singer Theory***

Schachter and Singer agreed with James and Lange that -- the experience of emotions arises from the cognitive labeling of physiological sensation. However, they also believed that this was not enough to explain the more subtle differences in emotion self-perception, i.e. the difference between anger and fear. Thus, they proposed that an individual will gain information from the immediate situation (ex: a danger is nearby) and use it to qualitatively label the sensation.

#### **B.1.4 *Donald A. Norman***

Donald A. Norman is a professor emeritus of cognitive science at University of California, San Diego and a Professor of Computer Science at Northwestern University, but nowadays works mostly with cognitive science in the domain of usability engineering. He also teaches at Stanford University and is a member of the editorial board of Encyclopædia Britannica. He is the author of a number of books on smart design including "The Design of Everyday Things," and "Emotional Design: Why We Love or Hate Everyday Things." He received 2006 year's Benjamin Franklin Medal in Computer and Cognitive Science at the Franklin Institute in Philadelphia. Norman is co-founder of the design-consulting firm the "Nielsen Norman Group" based in Silicon Valley.

#### **B.1.5 *Maslow's Hierarchy of Needs***

Maslow's hierarchy of needs is a theory in psychology that Abraham Maslow proposed in his 1943 paper A Theory of Human Motivation, which he subsequently extended. His theory contends that as humans meet 'basic needs', they seek to satisfy successively 'higher needs' that occupy a set hierarchy. Maslow studied exemplary people such as Albert Einstein, Jane Addams, Eleanor Roosevelt, and Frederick Douglass rather than mentally ill or neurotic people, writing that "the study of crippled, stunted, immature, and unhealthy specimens can yield only a cripple psychology and a cripple philosophy." (Motivation and Personality, 1987)

I think that this theory can also be used in industrial design practices. “Physical” and “Security” compose users’ physical needs. And the emotions aroused by these needs are lower level of emotion, such as visceral or behavior; meanwhile, “social”, “ego”, and



“self actualization” are the psychological needs which reflects personal identity and personality.

#### **B.1.6 *Dimensional Theories***

Dimensional approaches to emotion typically distinguish between a dimension of affective valence and a dimension of affective arousal (Bagozzi, Baumgartner, and Pieters 1998).

#### **B.1.7 *Attribution Theory***

Attribution Theory was developed to explain and predict behavior that arises from perceptions of causal factors (Weiner 1985; Weiner, Russel and Lerman 1979; Johnson and Stewart, 2005). Three distinct dimensions of causal attributions have been identified: 1) the locus of the cause (internal versus external to the individual), 2) the stability of the cause (like versus unlikely to recur), and 3) the controllability of the cause of the outcome of the relevant situation (controllable or not). These dimensions of attribution have been shown to be associated with different patterns of behavior and emotional reactions.

#### **B.1.8 *Imago Creative***

Imago is the only strategic marketing firm in the U.S. specializing exclusively in what is increasingly recognized as the “sweet spot” for a broad spectrum of industries: the convergence between women and Baby Boomers.

#### **B.1.9 *Boomerwomenspeak.com***

The online forum for middle-aged women to gather together, share feelings and exchange information. It was founded by Dotsie Bregel, who says the idea was hatched in an empty

nest. In 2004, monthly hits jumped to 300,000. This year, the site is averaging 850,000 hits each month.

#### **B.1.10 National Association of Baby Boomer Women ([nabbw.com](http://nabbw.com))**

The organization offer opportunities to network with other boomer women, free legal and financial advice, savings on products and services and information from a panel of experts on everything from women's health and domestic violence to traveling and second careers.

## B.2 FIGURE

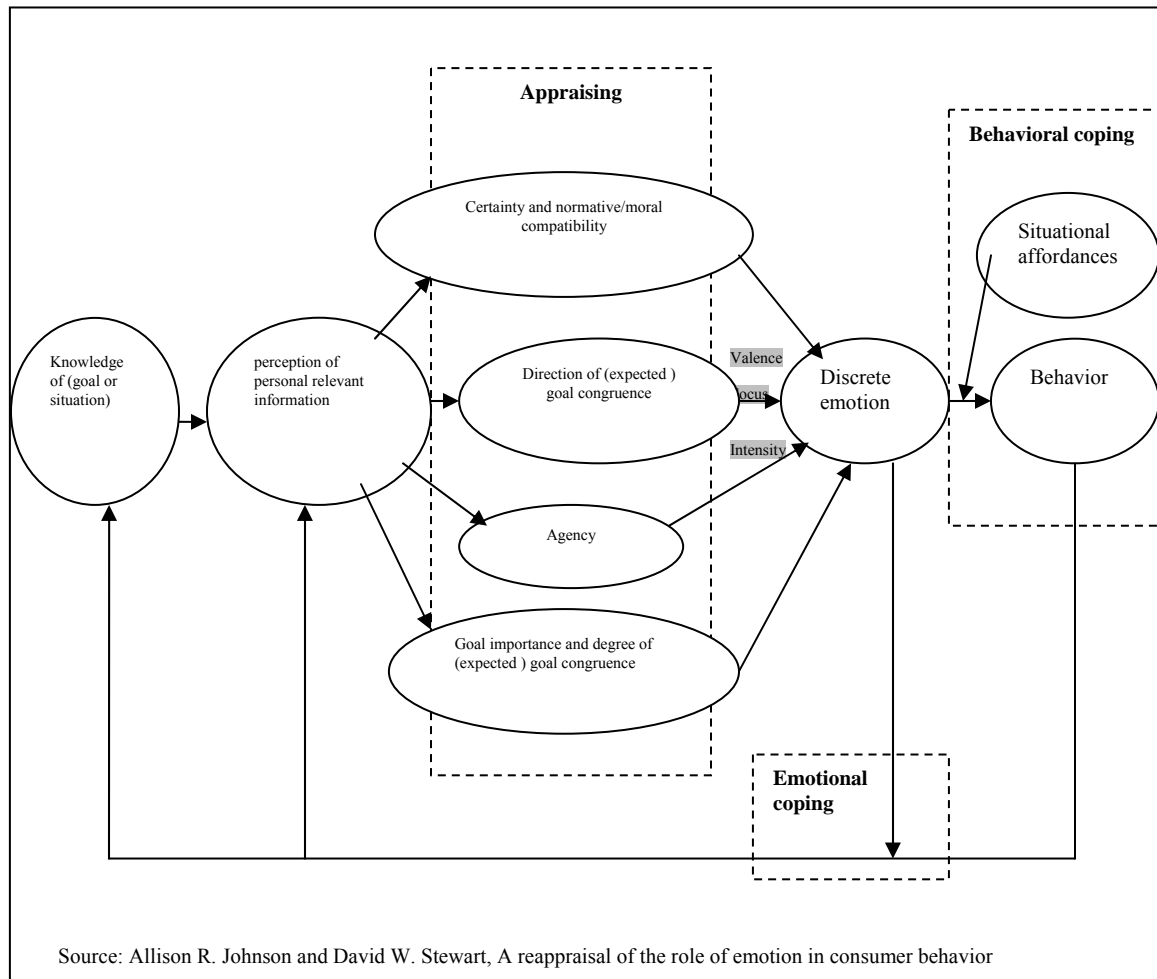


Figure B.2.1 Appraisal Model of Emotion

## B.3 TABLE

### B.3.1 *Dimension of Appraisal*

Source: Allison R. Johnson and David W. Stewart, A reappraisal of the role of emotion in consumer behavior

Appraisal	Definition of the Appraisal task	Emotion differentiation	Related terms
<b>Goal congruence</b>  Illustrative emotions: happy, sad, disappointed, pleasant surprise	Evaluating the situation in terms of (expected) goal success vs. failure, or whether it is consistent vs. inconsistent with values or ideals	Differentiates between positive and negative emotions (valence)	Intrinsic pleasantness Goal conduciveness motive consistency goal-path obstacle difficulty
<b>Agency</b>  Illustrative emotions: proud, angry, pitying, ashamed	Inferring whether there is a person (self or other) or object that is responsible for, or in control of, the situation	Differentiates emotions that focus on the self another person, or an object from emotions that do not reference and agent	Locus of causality responsibility attribution blame/credit intentionality
<b>Certainty</b>  Illustrative emotions: hopeful, joyous, anxious, sad	Determining whether the outcome is known or certain	Differentiates between outcome-related emotions and anticipatory emotions	Time of event temporal orientation probability likelihood
<b>Normative/ Moral comparability</b>  Illustrative emotions: proud, guilty, ashamed, embarrassed, evaluation, contemptuous, admiring,	Evaluation of morality and the probable evaluation of the situation by significant others	Differentiates emotions that reflect concern with moral values and the evaluations of others (versus emotions that do not reflect these concerns)	Legitimacy fairness consistency with others' standards internalized social standards self-evaluation, self-esteem object evaluation problem source
<b>Goal importance</b>	Evaluate the importance and value of the desired state in the current situation	Differentiate emotion intensity	Concern relevance/ urgency seriousness
<b>Degree of goal congruence</b>	Evaluate the extent to which the situation meets (or is likely to meet) expectations or approximates the desired state	Illustrative emotions: happy, joyous, anxious, afraid, irritated, angry, hopeful, expectant	Expectedness predictability perceived likelihood

### B.3.2 *Appraisal Combinations*

Source: Allison R. Johnson and David W. Stewart, A reappraisal of the role of emotion in consumer behavior

Goal congruence					
	Positive		Negative		
	Certainty				Normative/moral compatibility
Agency	Certain	Uncertain	Certain	Uncertain	
Moderate Intensity					
Self	Proud Happy	Hope Hope	Guilt, shame Distress	Anxiety Anxiety	Relevant Irrelevant
Other People	Admiration grateful	Hope Hope	Contempt Anger	Anxiety Anxiety	Relevant Irrelevant
Object or circumstances	Satisfied Pleased	Hope Hope	Disappointed Sad	Anxiety Anxiety	Relevant Irrelevant
Indeterminate or irrelevant	Glad Happy	Hope Hope	Pity Sad	Anxiety Anxiety	Relevant Irrelevant
High Intensity					
Self	Proud Joyous	Anticipatory Excited	Humiliated Depressed	Afraid Afraid	Relevant Irrelevant
Other People	Love love	Anticipatory Excited	Disgust Enraged	Afraid Afraid	Relevant Irrelevant
Object or circumstances	Delighted Delighted	Anticipatory Excited	Frustrated Miserable	Afraid Afraid	Relevant Irrelevant
Indeterminate or irrelevant	Delighted Joyous	Anticipatory Excited	Commiserate Miserable	Afraid Afraid	Relevant Irrelevant

### B.3.3 Food Storage and Time

Source: Tim Roberts, Extension Specialist, Food Safety, Department of Human Nutrition, Foods and Exercise and Paul Graham, Extension Specialist, Muscle Foods, Department of Food Science and Technology, Virginia Tech (\* Opened + Cooked ^ Refrigerate after opening # After manufacture date)

Food	Pantry (room temperature)	Refrigerator (33F to 40F)	Freezer (0F)
<b>Bread and Cereal Products</b>			
Bread, rolls unbaked		2-3 weeks	1 month
Cereals, ready-to-eat	1 year		
Cereals, ready-to-cook	6 months		
Corn meal	1 year	18 months	2 years
Rice, brown	6 months		
Rice, white	1 year		
Rice, white, (cooked)		6-7 days	6 months
Waffles		4-5 days	1 month
<b>Vegetables</b>			
Asparagus		2-3 days	8 months
Brussels sprouts		3-5 days	
Cabbage		1 week	
Carrots		2 weeks	
Cauliflower		1 week	
Celery		1 week	
Corn (husks)		1-2 days	8 months
Cucumbers		1 week	
Eggplant		1 week	
Green beans		1-2 days	8 months
Squash, Winter	1 week		
Tomatoes		1 week	
Vegetable soup		3-4 days	3 months
<b>Fruits</b>			
Apples	Until ripe	1 month	
Apricots	Until ripe	5 days	
Avocados	Until ripe	5 days	
Bananas	Until ripe	5 days (fully ripe)	
Berries	Until ripe	3 days	1 year
Canned fruit	1 year	2-4 days*	
Canned fruit juices	1 year	3-4 days*	
Peaches	Until ripe	5 days	1 year
<b>Dairy Products</b>			
Butter		2 weeks	9 months
Buttermilk		2 weeks	
Milk		8-20 days	
Sour cream		2 weeks	
Whipped cream, canned		3 days	
Yogurt		2 weeks	
<b>Meats, Poultry, Eggs and Fish</b>			
<b>Meats</b>			
Fresh beef steaks and roasts		3-4 days	6-12 months
Fresh pork chops		2-3 days	4-6 months
Fresh lamb chops		3-5 days	6-8 months
Cooked meat		2-3 days	2-3 months
Canned meat	1 year	1 week*	3-4 months
<b>Fish</b>			
Fresh fish		1-2 days	3-6 months
Seafood-shucked clams		1 day	3 months
<b>Poultry and Eggs</b>			
Canned poultry^	1 year	1 day*	
Cooked poultry		2-3 days	4-6 months
Egg yolks (covered in water)		2-4 days	1 year
Egg whites		2-4 days	1 year

## APPENDIX C

### CONSENT FORM

**Georgia Institute of Technology**  
**School of Architecture**  
**Consent to be a Research Participant**  
**Master Thesis, Spring 2006**  
**Project Title:** *Smart Product for Home-storage Solution*  
**Principal Investigator:** *Kevin Reeder (404 894 3937)*  
**Experimenter (student's name):** *Junhua Gu (678 462 2950)*  
**Location:** *At your home or other convenient location of your choosing*  
**Duration of Each Session:** *50 mins*  
**Number of Sessions:** *1*  
**Total Compensation:** *\$10 value gift*  
**Number of Participants:** *5 to 10*  
**Participation limitations:** *Working women between 45 and 60*

*You are being asked to volunteer for a research project (interview).*

**Study Description:** *The purpose of this research is to understand home grocery storage needs and customers' preferences for computerized products. The results from this study will be used to develop pantry storage products.*

**Procedures:** *An interview will be held at your home or other convenient location of your choosing. There are forty questions to be covered during the interview, which will take about 50 minutes to complete. After the questions, we will give you a disposal camera and a photo list to take home. You will take pictures of your current storage products and pantry. Do not take photos of any people. Any photos of people will not be used and will be destroyed. If you do not have the items on the list, please take a blank shot before shooting the next one. We will pick up the camera at your home on (date/time)\_\_\_\_\_.*

**Benefits:** *You will not benefit from being in this study. However, we hope that your participation will help us to understand your needs with respect to pantry storage product design.*

**Costs:** *There are no costs to you except for your time.*

**Compensation:** *Although we cannot pay you for your time, we will give you a gift at the end of the interview to thank you for participating. The value of the gift is about \$10.*

**Foreseeable Risks or Discomforts:** *The risks involved are no greater than those involved in daily activities.*

**Confidentiality:** *The following procedures will be followed to keep your personal information confidential in this study: The data that is collected about you will be kept private to the extent allowed by law. To protect your privacy, your records will be kept under a code number rather than by name. Your records will be kept in locked files and only the course teaching staff and the student researcher you worked with will be allowed to look at them. Your name and any other fact that might point to you will not appear when results of this study are presented or published. The pictures will only be used for this study. Your name will not be associated with the pictures. They will not appear in publications. Note, however, that there is no intent to publish the results of this class project outside of Georgia Institute of Technology. To make sure that this research is being carried out in the proper way, the Georgia Institute of Technology Institutional Review Board may review study records.*

**Injury/Adverse Reaction:** Reports of injury or reaction should be made to the supervising instructor, listed above. Neither the Georgia Institute of Technology nor the researcher has made provision for payment of costs associated with any injury resulting from participation in this study.

**Contact Persons:** If you have questions about this research, contact the principal investigator, Kevin Reeder at telephone 404 894 3937.

**Statement of Rights:** You have rights as a research volunteer. Taking part in this study is completely voluntary. There is not a penalty for not participating. You may stop taking part in this study at any time with no penalty. If you have any questions about your rights as a research volunteer, call or write: Melanie Clark, Office of Research Compliance, Georgia Institute of Technology, Atlanta, GA 30332-0420. Phone: 404-894-6942; Fax: 404-385-2081.

**Signatures:** A copy of this form will be given to you. Your signature indicates that the researchers have answered all of your questions to your satisfaction and that you consent to volunteer for this study.

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**Subject's Signature**

**Date**

---

**Person Obtaining Consent**

**Date**



## REFERENCES

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